JUN 18 1929

ENGINEERING AND
MINING JOURNAL

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Glory-Hole Limestone Mining at Davenport, Calif.

By George J. Young

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Views of Mining Activities in Africa . . . Personal Notes
Solikamsk Potash Deposits . . . Current Technical Literature
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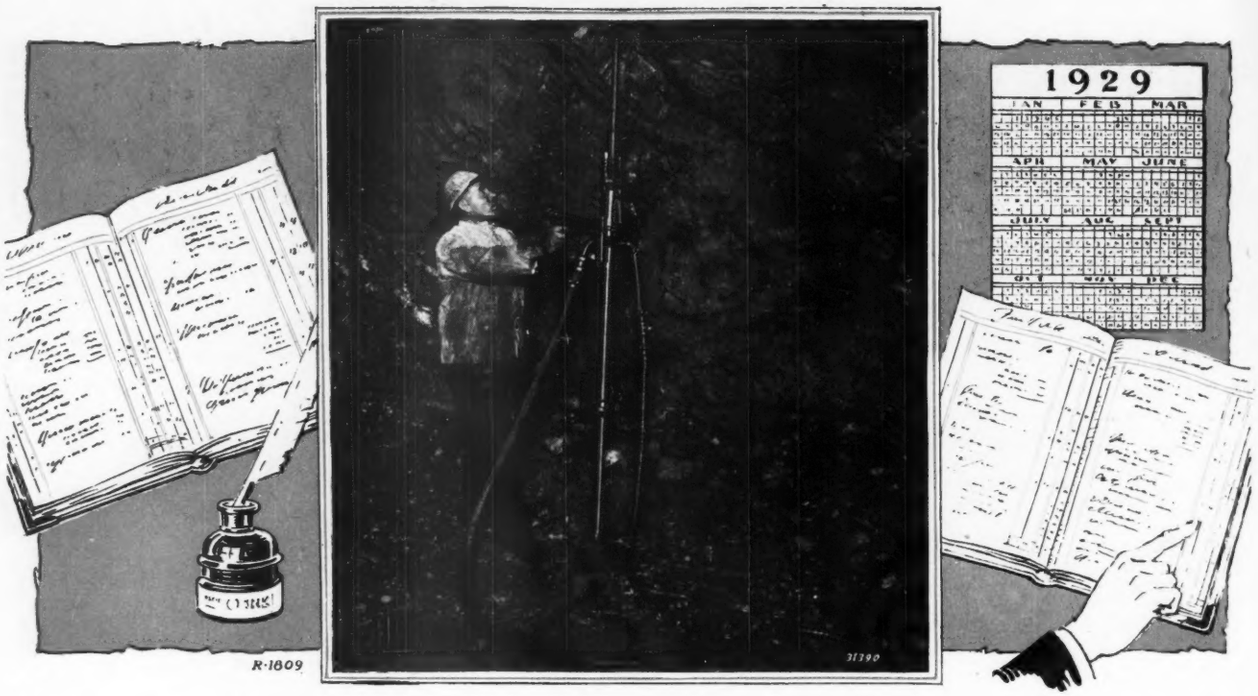

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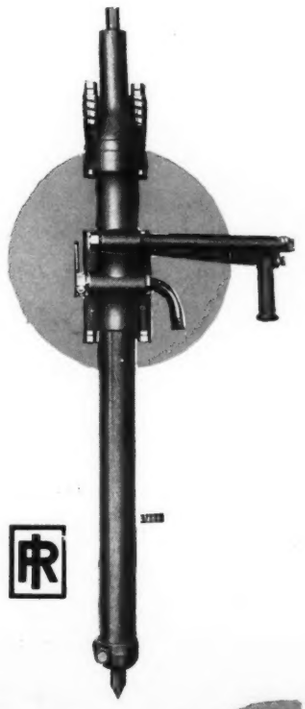

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Volume 127

ENGINEERING AND MINING JOURNAL

Number 24

A consolidation of "Engineering and Mining Journal" and "Mining and Scientific Press"

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New York, June 15, 1929

In the Anaconda Issue

Technical Papers on Geology, Mining Methods, Selective Flotation, Copper and Lead Smelting and Refining, and Electrolytic Zinc Practice

Out August Tenth

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McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Ave. at 36th St., New York, N. Y.

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NEW YORK District Office, 285 Madison Ave.
WASHINGTON, National Press Building
CHICAGO, 520 North Michigan Avenue
PHILADELPHIA, 1600 Arch St.
CLEVELAND, Guardian Building
ST. LOUIS, Bell Telephone Building
SAN FRANCISCO, 883 Mission St.
LONDON, 6 Bouverie St., London, E. C. 4

Cable Address: "Machinist, N. Y."

Publishers of
Engineering News-Record — American Machinist
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Coal Age — Engineering & Mining Journal
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Bus Transportation — Electric Railway Journal
Construction Methods — Radio Retailing
Aviation
Electrical West
(Published in San Francisco)
American Machinist—European Edition
(Published in London)

SUBSCRIPTION PRICES: United States, $6 a year. U. S. Possessions, Canada, Mexico and the countries of Central and South America, $7.50 a year. All other foreign countries, $10 a year. Single copy, 25 cents. Published weekly. Entered as second-class matter, June 20, 1879, at the Post Office, New York, N. Y., under the act of March 3, 1879. Printed in U. S. A.

CHANGE OF ADDRESS

Subscribers are requested to send both the old and the new address when they move to a new address.

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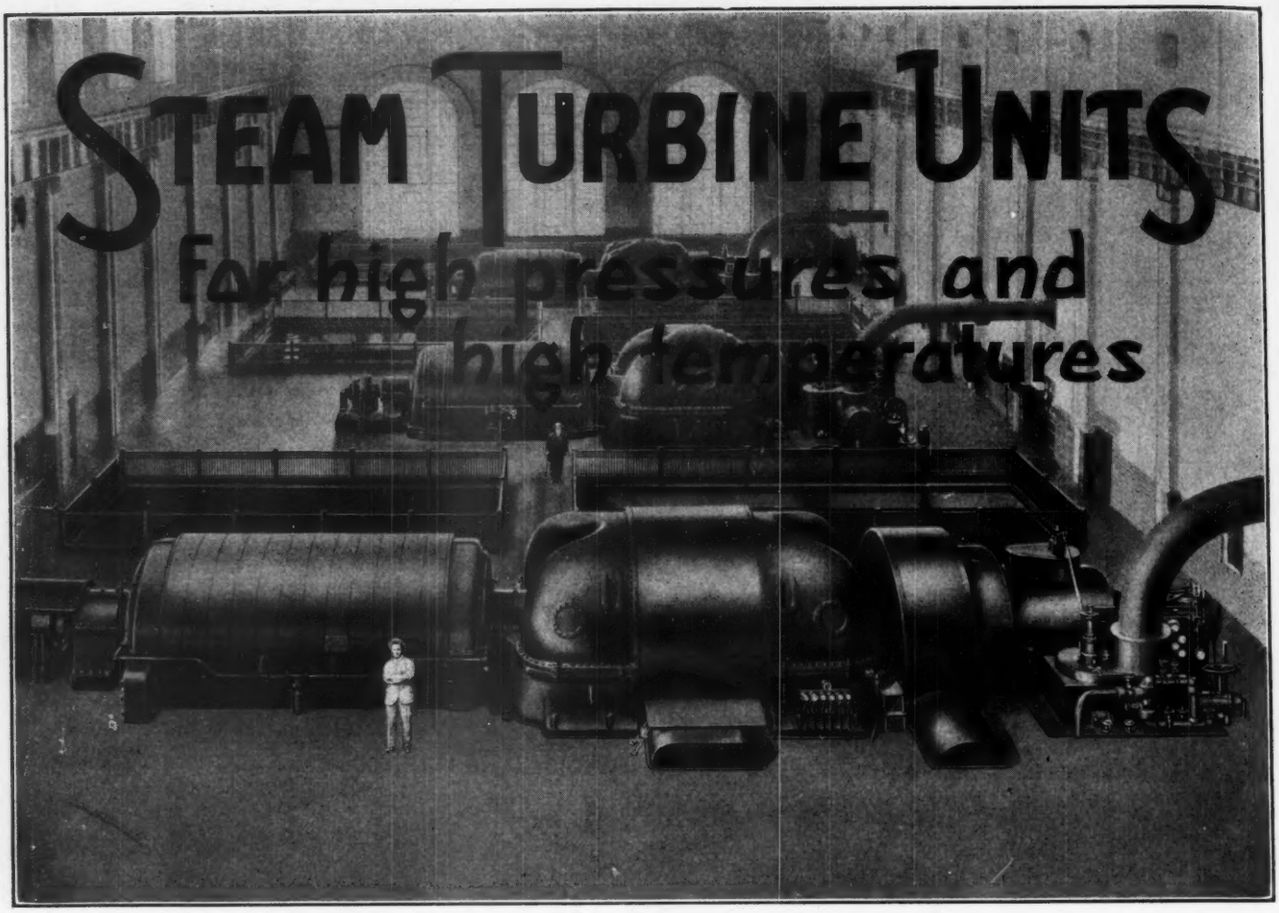
McGraw-Hill Publishing Company, Inc.
Member—Audit Bureau of Circulations.
Member—Associated Business Papers.

11,374 Copies Printed This Issue

Total Number of Issues to Date, 3,286



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Volume 127 — *New York, June 15, 1929* — Number 24

The Whole Truth Is Occasionally Unpleasant

THE COMMITTEE charged with the task of investigating recent economic changes in the United States, appointed by Mr. Coolidge while President, has brought its labors to a close by the issuance of a lengthy report. Mr. Hoover was chairman of the committee while Secretary of Commerce, relinquishing the helm when he was called to assume greater responsibilities.

The survey has provided arresting headlines for the newspapers. An important conclusion reached was that "economically we have a boundless field before us; that there are new wants which will make way endlessly for newer wants as fast as they are satisfied. . . . We seem only to have touched the fringe of our potentialities."

A calmer study of the survey, however, prompts some melancholy reflections; for one must soon realize that the committee has considered only the wants of respectable and law-abiding citizens, forgetful perhaps of the fact that the vaunted prosperity of the United States is accompanied by an unparalleled contempt for restraint that is also the outcome of seeking new wants and then satisfying them. The economic conditions attained have paved the way for license and immunity from penalty that are bringing the United States into disrepute among the other leading nations of the world.

A few extracts from the report prompt the query, "What Price Prosperity?" We read that "Acceleration rather than structural change is the key to an understanding of our recent economic development. . . . The acceleration of forces and its resultant rising standard of living have been facilitated by a continuing supply of funds. . . . We have communication to speed and spread the influence of ideas. . . . We have a great national opportunity. . . . The problems are many and difficult, but the degree of progress in recent years inspires us with high hopes. . . . Our nation is accustomed to rapid movement, to quick shifts in status; it is receptive to new ideas, ingenious in devices, adaptable. . . . Our situation is fortunate; our momentum is remarkable."

Unfortunately, these expressions of satisfaction and optimism can also be echoed by a Chicago gangster, thinking of his high-powered cars and his machine guns; the ingenuity and perseverance of his followers; the protection under which he operates; the funds at his disposal to enable him to pursue a career of iniquity, to maintain a luxurious standard of living for himself and his family, and to insure a magnificent funeral in the event of "accident."

Mr. Hoover is impatient of national self-laudation. He realizes that the trends of technology and industry and humanitarianism in the United States are along correct lines, but he refuses to be hypnotized by complacency or by an optimism that discloses only a part of the truth. In his recent address before the press in New York City he chose to dwell on the sordid side of national economics, discussing an industry of great prosperity and wide ramifications, pointing out that the death roll from acts of violence in the United States exceeds 9,000 human beings per annum. In comparison with Great Britain, homicides are in the ratio of twenty to one, and robberies are fifty times as numerous. Murderers are rarely brought to trial. Stories of embezzlement and the misuse of public and private funds provide an almost continuous flow of front-page copy for the newspapers.

Mr. Hoover has apparently evinced little interest in this report on "Recent Economic Changes" that was instigated by his predecessor at the White House. Instead, he has appointed a commission of leading jurists and publicists to study and to report on the status of criminal law in the United States and its enforcement. But, as the *Saturday Evening Post* avers, "A motley army of machine politicians, corrupt police departments, crooked contractors, dirty-work men, bootleggers, dope sellers, gangsters, promoters of commercialized vice, and receivers of stolen goods, backed by the entire rank and file of the underworld, will stand shoulder to shoulder to resist any serious effort to make crime less safe or less profitable."

This is the other side of the economic picture. Arraigned against this corrupt aggregation, continues Editor Lorimer, "is that large army of decent citizens, right thinking when it thinks at all, lukewarm and indifferent, too often smug in its own righteousness, content with hollow academic theories, prideful with shibboleths on our national greatness, and quaintly triumphant when some peculiarly bloodthirsty or careless criminal is brought to tardy justice."

Confession is good for the soul. Sincerity is a noble quality. For a nation to admit a damning fact frankly and courageously—as the Prince of Wales recently averred at Newcastle, England, in referring to the conservatism of British business men—is not pessimism, but rather the first condition of success. President Hoover is facing unpleasant facts as well as pleasant facts. Pending the result of the labors of the commission on crime in the United States, an attitude of greater national humility would not be unbecoming. It is time that the United States should begin to comprehend one of the reasons why other nations look askance at an economic condition that seems to be responsible for the enrichment and the protection of the criminal in addition to providing fair remuneration for the honest worker.

Investment and Speculation Are Not Synonymous Terms

INVESTMENT and speculation are frequently intertwined in curious fashion. Subtle suggestion is made by the promoter to the individual whose preference is inclined toward investment as distinct from speculation. Adroit means are taken to disturb settled tendencies. As an example of this, one of our friends received a letter recently, from which we quote, omitting specific names, as follows:

"In buying mining stocks there are two things to take into consideration. The first is—is the property behind the stock going to be developed? The second is—will this stock advance from a speculative standpoint?

"The ———— Company of Nevada, of which I am president, has applied to the ———— Mining Exchange to list their stock on that market for trading, and I can assure you that it is the intention of the officers of this company to push the development work on this property, and from the development work already accomplished on a 200-ft. level we are practically assured of a mine with sufficient free milling ore to make the stocks of our company a very attractive investment. The ———— Company, which has just placed their stock on the Exchange for trading, is to build a mill at ————, just 6 miles from our property, which will provide the means of handling the ore from our mine.

"Regarding the speculative feature, this can only be accomplished by public demand for the stock of any corporation, which controls the price of any commodity. In other words, supply and demand either advances the price of stocks or any other commodities or lowers them.

"I have received numerous inquiries asking for stock in this company previous to its being listed, and from the number received I feel sure there will be an active demand for ———— stock when it is listed for trading.

"It will be my pleasure to advise you when this stock will be available through the Exchange and will notify you of the date in advance, and any information you would care to have on this property, such as the engineer's report, or any other information, I will be glad to furnish same to you."

A few days thereafter the following telegram was received:

"—— COMPANY STOCK OPENS FOR TRADING. ——MINING EXCHANGE MONDAY MARCH EIGHTEEN. TAKE ADVANTAGE THIS ADVANCE INFORMATION AND BUY THROUGH YOUR BROKER AT MARKET ALL YOU CAN AFFORD. I RECOMMEND AS INVESTMENT TO HOLD ON. NICE PROFIT CAN BE MADE IMMEDIATELY ON ADVANCE IN PRICE."

The president of this company signed both the letter and the telegram. Obviously, his purpose was to sell the stock to create a buying interest. Like others of his kind, he dangled the bait of "quick turnover" at rising "prices" before his prospective victim. This kind of bait is "ground bait." Several hundred suckers taking the ground bait could be depended upon to attract other suckers, without recourse to more ground bait.

The president of the company states that "supply and demand either advances the price of stocks or any other commodities or lowers them." He controls the supply and his objective is to sweeten the parcel so that the demand will be developed. Notice how he dilates upon the "investment."

Any "price increment" resulting from energizing a buying interest goes almost wholly into the pockets of interested parties; it is not received by the treasury of the mining company. The thoughtless investor pays several times more than the money equivalent received by the mine for its stock. The experienced speculator is not concerned with this disposition of the "price increment." When the initial buying interest declines, as it always does, inexperienced "speculators" and innocent "investors" are left "holding the bag." Mining acquires more disrepute.

Ground baiting for speculative buying is as dishonest as a fictitious sale of stock. Both practices should be banned by reputable stock exchanges. The mailing of a letter of the kind described should be a good and sufficient cause for removing the stock from the boards of an exchange.

Ability to Judge—An Asset of Rare Quality

EDUCATION has been defined by William James, the philosopher, as the organization of acquired habits of conduct and tendencies to behavior. This interpretation may be objected to by those who fondly believe that the function of the college is to cram the youthful cranium with facts and theories, and who are prone to confuse "education" with the outcome of a retentive memory.

The James definition, however, is as good as many and better than most. At least it has a humanitarian flavor to it. The personal touch is needed more and more in the development of the new civilization, in which individual or group differences are no longer settled, in a manner calculated to breed rancor and hate, by high explosives.

"Let no youth," says James in one of his essays, "have any anxiety about the upshot of his education, whatever the line of it may be. If he keep faithfully busy each hour of the working day, he may safely leave the result to itself. He can with perfect certainty count on waking up some fine morning to find himself one of the competent ones of his generation, in whatever pursuit he may have singled out. Silently, between all the details of his business, the *power of judging* will have built itself up with him as a possession that will never pass away." All of which goes to show that education continues long after school and college.

A rare qualification, that power of judging! Not the outcome of acquired facts or impressions, or experience, or training, but rather the result of continued personal research and unremitting experimentation. Less the result of heredity and environment than any other factor.

Industry needs character and purpose as well as skill and knowledge. Accept this thesis, then realize how important a part education should play in the qualifications of an official deputed with the responsibility of making choice in the selection of personnel.

Employment managers are mostly classifiable into two types: those who judge a man by looking at his record, and those who select by also looking foward at what he might do. The former are more frequently dissappointed because a record that is past is no guarantee of future performance; it is merely a finger post that may decide to point in the opposite direction if conditions change and mischievous influences come into play.

Character is the best indicator of future performance. What really counts in an employee is the power to organize acquired habits so that routine becomes second nature, without prior thought or necessity for mental decision, leaving all the more time to the exercise of an ability to judge that is the antithesis to mediocrity.

Reduction in Price of Radium Unlikely at Present

IN SKILLED and experienced hands, radium has been used extensively and successfully for the treatment of cancer. Carelessly contacted, as a constituent of luminous paint, it has caused fatalities and serious illness. About a year ago, death by now was predicted for five women workers then employed by a company manufacturing luminous watch dials at Newark, N. J. All five are alive today, but one is incapacitated, and the condition of the others ranges from lameness to a necessity for regular treatments. Such impairment of physical well-being makes evident the importance of a recent order issued by the U. S. Navy Department, listing precautions to be taken in the use of such luminous material. These precautions, which were prepared by the Bureau of Medicine and Surgery, provide additional knowledge that can be used by industry in safeguarding workers from radium poisoning.

Supplementing the attention directed toward the poisoning of industrial workers in the United States by radium is the recent criticism in England anent the comparatively small supply and presumably high price of the element for hospital use. This criticism may or may not be justified, but to some extent, at least, it appears unreasonable when the price of $120,000 to $130,000 per gram, which prevailed about eight years ago, is recalled. At that time the United States was producing about 90 per cent of the world's output, from carnotite ores. Subsequently, Union Minière discovered the Belgian Congo pitchblende ores, which are about fifty times richer in radium content. Last year this company produced slightly more than 40 grams, or about 85 per cent of the world's output of radium. In an effort to sell its steadily increasing production Union Minière some years ago reduced the price for the element, which is now quoted at $70 per milligram. But, even at this price, radium is more difficult to sell than to produce, according to reports.

Union Minière is said to have made a heavy investment in research work and in constructing a plant for the extraction of radium from the pitchblende ores; and it established an extensive selling organization, which sent out specialists to instruct hospital staffs and others in the use of radium for the treatment of cancer. Even so, the company's total output of radium could not be sold. In view of this capital investment and small possibility of expanding materially the market for the element, a decrease in the price of radium for either hospital or industrial use does not seem probable in the near future.

Greater Annual Increase in Copper Consumption Probable

AN ANALYST, basing his conclusions on a study of statistics for the period of 1911-1928, recently made the deduction that a continuation of the 6 per cent cumulative per annum increase in the domestic and world consumption of copper seemed justified. This prediction would seem conservative, not only because of the sustained increased demand in the first quarter of this year on the part of consumers of large quantities of the metal, but also owing to the new and wider fields of application for copper that are being developed.

Electrification of steam railroad lines, which has required so far only comparatively small quantities of copper, should expand substantially in the near future; demands of the automobile industry, according to present indications, will continue at an increased rate; the aviation industry, heretofore almost a negligible factor, will become a consumer of considerable quantities of copper; and the energy output of public-utility plants, which has increased 10 per cent annually in the United States in the last few years, will undoubtedly continue to increase at this or a greater rate, and will consequently require increasing amounts of manufactured copper products. In Europe, where the per capita consumption of copper is less than half that in the United States, a large potential market for the metal prevails. Increased use of automobiles, safety razors, radio receiving sets, electric refrigerators, and washing machines, to mention a few of the miscellaneous items for which considerable quantities of copper must be allocated in the United States each year, will affect materially the world demand.

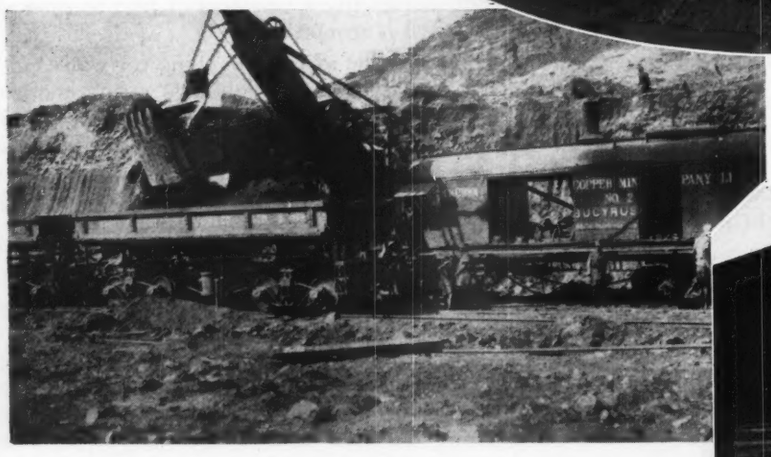
Of the new uses for copper, the one offering the most interesting possibilities, perhaps, is that developed recently in England in connection with a new method for heating buildings. In this method an electric element inside of copper tubing placed along the wainscoting of a room evenly distributes heat, the temperature of the room being controlled automatically by a thermostat, according to individual needs. Radiation of the heat by the copper provides an almost immediate source of heat as soon as the current supplying the electric element is turned on, and as effective a cessation of heat as soon as the flow of current is stopped.

The recent application of copper tubing for water connections from street mains to buildings opens another new and wide field for the metal. Included among the advantages that copper can claim justly in this instance are: It can be bent without injury and is notably resistant to corrosion; joints can be made without threading; it has ample strength to withstand the water pressures employed; and coils of the tubing are light in weight and easily carried by one man, who can complete an installation without assistance. Additional new and apparently important outlets for copper in the near future are copper-bearing steels and copper heating radiators. Those most concerned with the increased use of copper—the copper mining companies—might well use more copper and brass piping in place of a cheaper alternative that corrodes, causing delay for replacement and high initial and operating expense. In brief, therefore, the demand for copper seems likely not only to be sustained at its recent annual rate of increase, but also to reach a new high rate in the next few and succeeding years.

MINING ACTIVITIES IN A

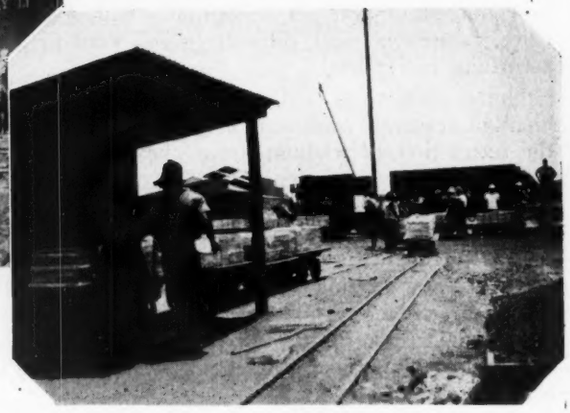
The Lubumbashi smelter of the Union Minière

Oval—An aërial view of the Lonely Reef mine



Above—A steam shovel loading Western dump cars at Bwana M'Kubwa

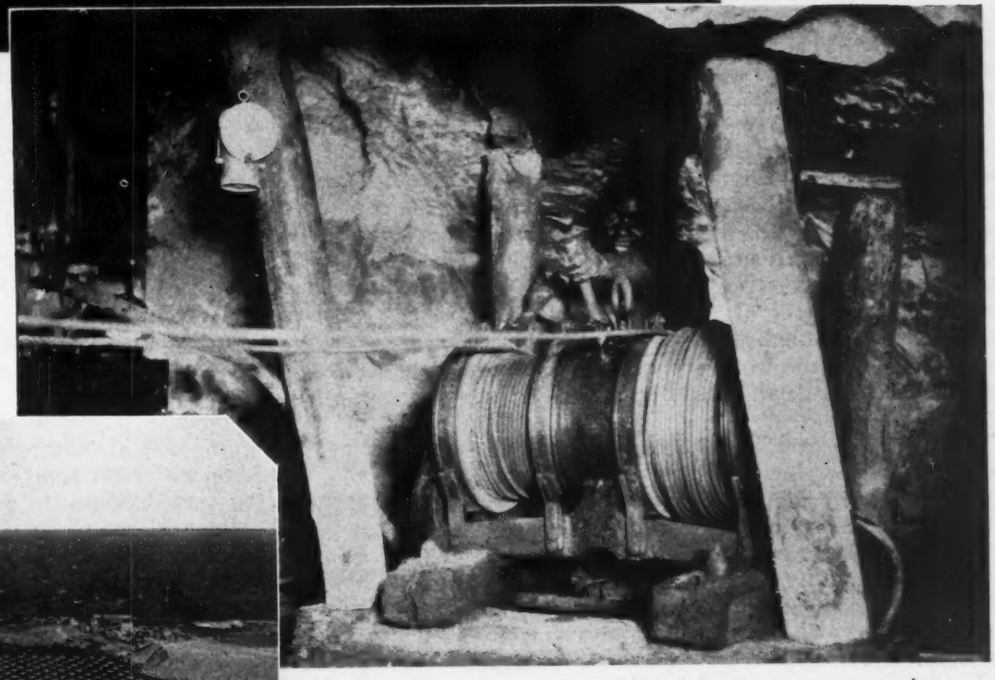
Below—Dispatching slab zinc from Broken Hill



AFRICA

Above — Incline shaft of the Potgietersrust platinum mine, in the Rustenburg district

Left—Loading chrome ore into trucks at Selukwe



Right—Operating a winch on the Far East Rand

Left—Native compounds at the Lonely Reef

Soviet Solikamsk Potash Deposits

May Rival Those of Stassfurt and Alsace

RAPID PROGRESS is being made in the development of the Solikamsk potash deposits located near the Upper Kama River in the northwestern part of the Urals, according to the Information Department of the Amtorg Trading Corporation. Two shafts are being sunk and are now almost at the level of the first workable vein, at a depth of 120 meters. By September of this year it is expected to make the first shipment of potassium salts. During the fiscal year 1929-30 the production is planned at 500,000 tons of potassium salts, which, it is expected, will be increased to 1,200,000 to 1,500,000 tons (180,000 to 225,000 tons K_2O) in the succeeding few years. A narrow-gage railway, roads, sawmills, machine shops, a brick factory and other subsidiary structures have already been built. A German engineering firm is furnishing technical assistance on the work.

THE discovery a few years ago, by the Soviet Geological Survey, of important beds of potassium salts was an event of far-reaching importance in the economic life of the nation. Extensive researches carried on during the last few years indicate that the potash deposits in this district may rank as the largest in the world. In the surveyed area (30 to 40 square kilometers) the content of pure potassium oxide has been found to average about 11.5 million metric tons per square kilometer. This would give a total of about 350 to 450 million tons of potash for the entire surveyed area, extracted from 1¾ to 2¼ thousand million tons of carnallite and sylvanite. By way of comparison it may be stated that these totals exceed the reserves of the Alsace deposits in an area of 172 square kilometers, which are estimated at 1½ thousand million tons, with a potash content of about 300 million tons. That is, the potash content per unit of area of the Soviet deposits is indicated to be more than five times as large as that of the Alsace deposits. However, the Solikamsk deposits constitute only a part of the total resources of the region in which potassium salts have been found. Recent estimates of the Geological Survey put the resources of the region, covering an area of from 300 to 400 square kilometers, at not less than 4 thousand million tons of potassium salts. Another point of great importance is the fact that the workable Soviet deposits are located at depths of from only 95 to 200 meters, whereas the Stassfurt and Alsace deposits, now the principal sources of the world's potash supply, have to be extracted from a depth of 600 meters.

CHEMICAL analyses of the potassium salts of the Urals region show that they are of a superior quality, being higher in potassium content than either the Stassfurt or Alsace salts and, at the same time, they are free of the detrimental magnesium salts found in the latter deposits. An average sample of Solikamsk carnallite showed a content of potassium chloride of 23.55 per cent, compared with 16.0 per cent for average Stassfurt carnallite and 19.5 per cent for Alsace carnallite. The Solikamsk sample contained no kieserite (magnesium sulphate), whereas the Stassfurt and French carnallites contained 12.0 and 9.3 per cent respectively.

Samples of Solikamsk sylvanite were also found to be free from kieserite, whereas German sylvanite analyzed from 0.1 to 1.0 per cent of the compound. Various Solikamsk samples analyzed showed a potassium chloride content varying from 18.4 to 44.1 per cent compared with 28 to 40 per cent for German sylvanite. The total thickness of the working layer of the upper sylvanite and carnallite zones is about 40 meters, with an average potassium chloride content of 21.5 per cent; the lower sylvanite zone averages 12.5 meters in thickness, with 24.5 per cent potassium chloride content.

The great extent, the comparatively moderate depth, the high potassium content, the absence of magnesium sulphate, and the considerable thickness of the beds indicate that the Solikamsk deposits may well be the best of their kind so far discovered anywhere, and, if so, they should play an important part in the world market in the not too distant future.

The internal market for Solikamsk potash will be large and steadily increasing. The government, in its five-year plan for the development of the national economy, has set a goal of increasing the yield per unit of agricultural area in the Soviet Union by 30 to 35 per cent within the period covered by the plan. This will necessitate an intensive development of the fertilizer industries.

ESTIMATES of the cost of Solikamsk potash show that it can be delivered to the consumption centers —1,500 to 2,000 kilometers from the Solikamsk mines— at a cost of 21 rubles ($10.82) per ton, only 40 per cent of the cost of the Stassfurt salts now imported, which is about 54 rubles ($28) per ton. This calculation is based on a cost at the mine of 4.50 rubles per ton of raw potassium salts containing 21 to 24 per cent of potassium chloride (14.5 to 15 per cent potassium oxide). This is the cost of rock salt mined under conditions similar to those prevailing at the Solikamsk mines, but with less efficient equipment than the modern machinery being installed at Solikamsk. After recrystallization, 2.2 tons of sylvanite gives one ton of concentrated salt containing 30 per cent of potassium oxide. Since the cost of the process does not exceed 1 ruble per ton (51c.), the cost of a ton of 30 per cent potassium oxide salt will be about 11 rubles ($5.70). To this must be added the existing freight rate of 10 rubles ($5.15) per ton. With the completion of the Volga-Don Canal the freight cost will be less. Moreover, the government is now considering lowering the freight rate on potassium salts.

Great, also, are the export possibilities. Adding the freight rates of 12 rubles ($6.20) per ton from the mines to the port of Novorossisk (2,500 kilometers) and the additional freight from that port to the Atlantic ports of the United States, to the cost of 30 per cent salt, f.o.b. mine—11 rubles—it is seen that the salt can be delivered to the United States at a cost enabling the Solikamsk potash to compete with the Alsace or Stassfurt salts.

IN SPITE of the fact that work is progressing favorably on the opening of the first two mines, the Soviet economic authorities have recently announced that they would welcome the participation of foreign capital in the potash industry in the form of a concession. In this way the development of the industry could be accelerated.

Testing Reagents for the Flotation of Carbonate Lead-Silver Ores

By L. J. CHRISTMANN and S. A. FALCONER
Technical Department, American Cyanamid Company

PRESENT-DAY PRACTICE in the flotation of sulphide ores has attained a high degree of efficiency, and there are few such ores that cannot be treated by the flotation process. The flotation of non-sulphide minerals is, however, comparatively new. This paper describes a study of the flotation of lead carbonate conducted in the experimental laboratory of the American Cyanamid Company.

In general, two methods are available for the flotation of lead carbonate. According to more common practice, the ore is treated before flotation with a sulphidizing agent, sodium sulphide for example, after which the flotation operation proceeds with the addition of the usual reagents for sulphide minerals. The second method omits sulphidizing and employs a reagent specifically adapted to the flotation of lead carbonate. The first method frequently encounters difficulties owing to the fact that an excess of sodium sulphide may act as a depressor of flotation. Because satisfactory reagents have not been available heretofore, the second method is rarely applied.

In this work we aimed at the development of a flotation collector having an effect on lead carbonate similar to that exerted on lead sulphide by such reagents as Aërofloat or the xanthates. A reagent was needed that would act selectively upon lead carbonate, separating it directly from the gangue constituents of an ore without recourse to sulphidizing treatment.

In carrying out this study we found it convenient to conduct the preliminary experiments with pure minerals. The effect of a large number of organic compounds on the flotation of pure cerussite was first determined, and the compounds that gave the most promising results were selected for further study. These compounds were then used in carrying out tests on synthetic "ores," prepared by mixing cerussite with common gangue constituents; if any compound exhibited the ability to separate the lead mineral from the gangue constituents, it was tested upon a natural ore.

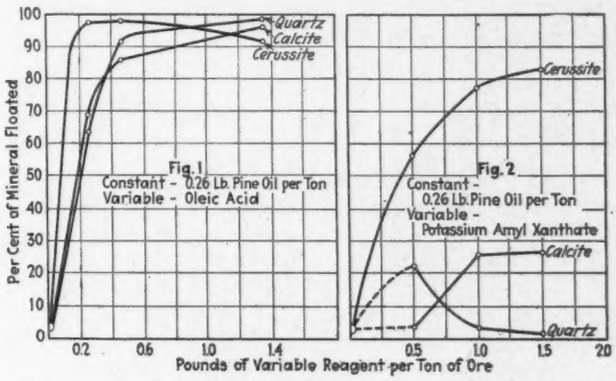
Table I—Effect of Various Promoters on the Floatability of Pure Minerals

Constant—0.26 lb. pine oil per ton of mineral.

Reagent	Pounds per Ton	Per Cent of Mineral Floated Cerussite	Quartz	Calcite
Pine oil	0.26	4.8	2.0	2.6
Oleic acid	0.22	97.8	64.4	69.8
	0.45	98.6	92.2	85.2
	1.34	92.0	99.0	96.2
Potassium amyl xanthate	0.5	56.6	22.0	4.2
	1.0	77.8	4.2	5.2
	1.5	83.8	1.8	5.8
No. 204	0.36	88.2	1.8	11.0
	0.72	94.4	1.4	12.4
	1.44	97.8	3.0	16.0
No. 404	0.1	12.4	0.6	3.2
	0.2	82.4	1.0	8.8
	0.5	93.8	2.2	6.2
	1.0	98.8	4.0	9.4
	1.5	98.8	6.4	11.8

Flotation characteristics of cerussite, quartz, and calcite were determined in the small 50-gram machine designed by Jacobsen and Gates and described in *Engineering and Mining Journal-Press* of May 9, 1925.

In the testing procedure 50-gram portions of the minerals were stirred for five minutes in the flotation machine with 135 c.c. of distilled water. Frother and collector reagents were next added to the machine and the mixture was stirred for two minutes. The water level was then brought up to the edge of the spitzkasten,


Per Cent of Mineral Floated
Quartz
Calcite
Cerussite
Fig. 1
Constant - 0.26 Lb. Pine Oil per Ton
Variable - Oleic Acid
Fig. 2
Constant - 0.26 Lb. Pine Oil per Ton
Variable - Potassium Amyl Xanthate
Pounds of Variable Reagent per Ton of Ore

Effect of pine oil, and oleic acid or potassium amyl xanthate on the flotation recovery of cerussite, quartz, and calcite

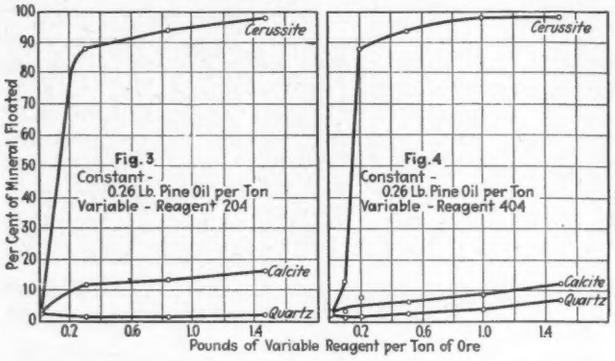
the water run in from the constant-level water-bulb, and the mineral floated off for five minutes without skimming. Pulp dilution in all tests was approximately 4:1.

Table I shows results obtained with these minerals when certain collectors were used with pine oil. Oleic acid was employed as typical of the fatty acids which have been used in early attempts at non-sulphide flotation. Potassium amyl xanthate also was tested because it had been found effective in actual mill practice for the flotation of oxidized lead minerals. The numbered reagents are new materials developed in our own laboratory. The data are presented graphically in Figs. 1, 2, 3, and 4.

Results with oleic acid shown in Fig. 1 are typical of many experiments in which various fatty acids were used. Fatty acids are excellent collectors for lead carbonate, but are lacking in selectivity. Fig. 2 shows the results obtained with potassium amyl xanthate. It will be seen that potassium amyl xanthate acts selectively on cerussite, permitting a separation from quartz and calcite; however, considerable quantities of the reagent are necessary in order to secure a satisfactory recovery. Fig. 3 shows the results obtained with a special reagent, No. 204. The separation between cerussite and the gangue minerals, calcite and quartz, is good, and the reagent is effective when used in relatively small amounts. Fig. 4 shows results obtained with another special reagent, No. 404. This reagent is easier to manufacture than No. 204, and also gives somewhat better results

when used in equal amounts. As will appear from the results reported later in this paper, reagent No. 404 has proved effective on natural ores, and we believe it offers promise for commercial applications.

That satisfactory mineral separation can be effected when reagent No. 404 is applied to a synthetic "ore" is shown in Table II. The synthetic "ore" consists of approximately 30 parts by weight of cerussite with 45 parts of quartz and 25 parts of calcite. This synthetic



Effect of pine oil, and reagent No. 204 or reagent No. 404 on the flotation recovery of cerussite, quartz, and calcite

"ore" was treated in a flotation machine, in one instance with a mixture of oleic acid and pine oil and in the other with reagent No. 404. As No. 404 has inherent frothing properties, it was not necessary to use pine oil with it. No attempt was made to find the best possible conditions, but it will be apparent from the data that oleic acid has given virtually no separation, whereas reagent No. 404 has given a ratio of concentration somewhat better than 2:1.

Table II—Separation Effected with Mixed Oleic Acid and Pine Oil, and with Reagent No. 404 on Synthetic "Ore"

Feed		Concentrates		Tailings		Per Cent Recovery in Concentrate		Reagents—Pounds per Ton		
Per Cent		Per Cent		Per Cent						
Lead	"Insol."	Lead	"Insol."	Lead	"Insol."	Lead	"Insol."	Pine Oil	Oleic Acid	No. 404
20.0	52.6	21.70	50.8	3.22	71.0	98.5	87.9	0.26	0.5	...
18.0	53.5	38.76	27.0	2.50	73.1	92.0	21.6	....	...	1.0

Tests on pure minerals merely indicate that, under suitable conditions, a specific reagent is capable of floating a certain mineral. The pure-mineral tests reported in the foregoing show that reagent No. 404 is capable of floating cerussite and that it has comparatively little action upon two typical gangue minerals, calcite and quartz. Whether this reagent is capable of effecting the recovery of lead carbonate from natural ore depends, therefore, upon the presence or absence of other gangue constituents that might affect the flotation operation unfavorably.

Flotation of Natural Ores

In general, it has been found that good results are not obtained on ores of this general type when the collector is applied alone to the ore, and an additional problem is presented of finding a modifying or conditioning agent that will act upon the gangue or soluble materials in the ore in such a manner as to permit the collector to function. The question of gangue interference is of primary significance in flotation research. The problem of adapting a collector to any individual ore becomes largely a question of finding a proper method for conditioning the ore pulp before the collector is added.

Our first experiments were performed on a high-grade oxidized lead-silver ore from the Tintic district, in Utah, with the following analysis:

Ore No. 1

	Per Cent		Per Cent
Total lead	29.60	"Insoluble"	42.35
Non-sulphide lead	25.93	Calcium oxide	1.35
Total zinc	0.53	Magnesium oxide	0.28
Non-sulphide zinc	0.45	Copper	0.065
Iron	6.96	Gold, ounces per ton	0.155
Sulphur	4.90	Silver, ounces per ton	11.93

The effects of reagent No. 404 on this ore were studied. Used without any conditioning agent, only fair results were secured, whereupon various conditioning reagents were tried. Lime was found unsatisfactory and sulphuric acid was only moderately effective. The best results were obtained with the use of phosphoric acid. Comparative results that were obtained with and without phosphoric acid are shown in Table III. In these experiments the phosphoric acid was added to the mill. As the ore is strongly basic, the acid addition is not sufficient to change materially the hydrogen-ion concentration of the ore pulp. Analysis of the pulp solution after grinding indicated that the phosphate had been completely removed from solution.

Table III—Effect of Phosphoric Acid on Lead Recovery: Ore No. 1 with Reagent No. 404

Feed		Concentrates		Tailings		Per Cent Recovery in Concentrates		Reagents—Pounds per Ton	
Per Cent		Per Cent		Per Cent					
Lead	"Insol."	Lead	"Insol."	Lead	"Insol."	Lead	"Insol."	Re-agent No. 404	Phos-phor-ic Acid
25.7	43.8	53.5	15.1	12.5	58.8	67.2	11.1	2.0	...
26.0	45.1	61.95	8.8	4.6	66.6	89.0	7.3	2.0	5.0

Grinding time, twelve minutes. Flotation, fifteen minutes.

In each test 1.0 lb. per ton of No. 404 was added at the beginning of the flotation period and the remainder at the expiration of five minutes. The phosphoric acid was added at the ball mill.

Because the use of phosphoric acid would be undesirable, owing to the expense and difficulty of handling, the experiments were continued, using a commercially available phosphate manufactured by the American Cyanamid Company, known as Ammo Phos. Ammo Phos is a fertilizer grade of mono-ammonium phosphate. In Table IV the effect of varying amounts of Ammo Phos on flotation with reagent No. 404 is shown. In

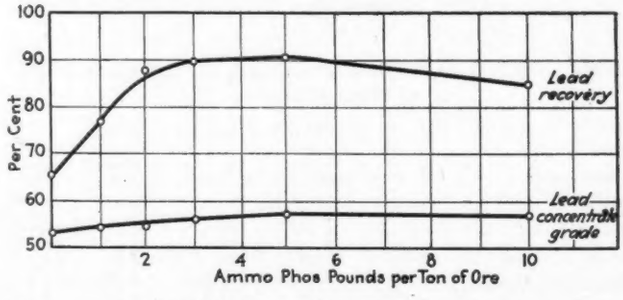


Fig. 5 — The effect of varying quantity of Ammo Phos, with addition of a constant amount of reagent No. 404, on lead recovery and grade of concentrate

all of the experiments the Ammo Phos was added to the ball mill. Of the collector, 1.0 lb. per ton was added at the beginning of flotation and the remainder after five minutes. The flotation time in all tests was fifteen minutes. Results are shown graphically in Fig. 5.

When sulphidizing reagents are employed in the flotation of lead-carbonate ores, the silver recovery may not be as high as the lead recovery, possibly, because sodium

Table IV—Effect of Ammo Phos on Lead Recovery, Using Reagent No. 404

Feed —Per Cent—		Concentrates —Per Cent—		Tailings —Per Cent—		Per Cent Recovery in Concentrates		Reagents —Pounds per Ton	
Lead	"Insol."	Lead	"Insol."	Lead	"Insol."	Lead	"Insol."	Ammo Phos.	No 404
25.7	43.8	53.5	15.1	12.5	58.8	67.2	11.1	...	2.0
25.8	45.8	54.3	16.2	9.2	63.1	77.6	13.0	1.0	2.0
26.1	44.1	55.1	14.4	5.3	65.4	88.2	13.6	2.0	2.0
26.2	43.6	57.2	13.0	4.5	65.5	90.0	12.3	3.0	2.0
26.0	44.9	58.3	12.5	3.9	67.0	91.0	11.3	5.0	2.0
26.5	43.8	57.5	14.0	6.3	63.3	85.6	12.7	10.0	2.0

sulphide acts as a depressant of the silver mineral. Satisfactory silver recoveries appear to be obtained when reagent No. 404 is used, as shown by the data of Table V.

Table V—Ore No. 1—Precious-Metal Recoveries with Varying Amounts of Reagent No. 404

Reagents, pounds per ton.....	No. 404	2.0	1.0
	Ammo Phos	5.0	5.0
Feed.....	Per cent lead	2.6	24.2
	Per cent "Insol."	44.9	48.4
	Silver, ounces per ton	13.63	15.57
	Gold, ounces per ton	0.103	0.108
Concentrates.....	Per cent lead	58.3	57.2
	Per cent "Insol."	12.5	14.5
	Silver, ounces per ton	29.64	35.74
	Gold, ounces per ton	0.18	0.20
Tailings.....	Per cent lead	3.91	3.08
	Per cent "Insol."	67.0	69.9
	Silver, ounces per ton	2.74	2.73
	Gold, ounces per ton	0.05	0.05
Per cent recovery in concentrates	Lead	91.0	92.2
	"Insol."	11.3	11.7
	Silver	88.1	89.3
	Gold	71.1	71.8

Ore No. 2 was from the same source as No. 1, and of similar analysis, except for a higher silver content. As shown by the data of Table VI, reagent No. 404 was particularly effective in recovering the lead content of this ore. Precious-metal assays were not made.

Table VI—Ore No. 2—Reagent No. 404 and Ammo Phos

Feed —Per Cent—		Concentrates —Per Cent—		Tailings —Per Cent—		Per Cent Recovery in Concentrates		—Time— Minutes	
Lead	"Insol."	Lead	"Insol."	Lead	"Insol."	Lead	"Insol."	Grinding	Flotation
25.0	52.6	47.8	23.1	2.28	82.2	95.4	21.8	12	15
25.7	47.7	48.6	15.2	1.71	82.0	96.8	16.3	15	15

In each test 1.0 lb. per ton of No. 404 was added at the beginning of the flotation period and 1.0 lb. after five minutes. Five pounds per ton of Ammo Phos was added at the ball mill in each test.

A few experiments were performed on a low-grade ore of the following analysis, also from the Tintic district:

Ore No. 3

	Per Cent		Per Cent
Total lead.....	5.30	"Insoluble".....	66.20
Non-sulphide lead.....	2.83	Calcium oxide.....	0.45
Sulphide lead.....	2.47	Sulphur.....	5.46
Zinc.....	0.60	Gold, ounces per ton.....	0.065
Copper.....	0.23	Silver, ounces per ton....	15.38
Iron.....	11.18		

Inasmuch as it was not desirable to treat this ore alone, because of existing economic conditions at the plant where it is to be treated commercially, only a few preliminary experiments were made. The results of one of these are shown in Table VII. An 85 per cent recovery of lead was obtained with a ratio of concentration of about 4:1.

One-half pound per ton of reagent No. 404 was added at the beginning of the flotation period and an additional 0.5 lb. per ton at the expiration of five minutes. A total of 5.0 lb. per ton Ammo Phos was added at the ball mill.

Ore No. 3 is high in pyrite, which reduced the grade of the concentrates. Precious-metal assays were not made. That silver recoveries were good is shown in Table VIII, where a composite of ore Nos. 2 and 3 was treated. This composite sample was secured by mixing two parts of ore No. 2 with one part of ore No. 3. This mixture contained approximately 20 per cent lead and about 25 oz. silver per ton of ore. The results of experiments with this mixture are shown in Table VIII.

Table VII—Ore No. 3, Reagent No. 404

Feed.....	Per cent lead	5.25
	Per cent iron	11.35
	Per cent "Insol."	67.2
Concentrate.....	Per cent lead	18.5
	Per cent iron	20.5
	Per cent "Insol."	27.7
Tailing.....	Per cent lead	1.09
	Per cent iron	8.50
	Per cent "Insol."	79.9
Per cent recovery in concentrate	Lead	84.3
	Iron	42.9
	"Insol."	9.8

Ammo Phos was added to the grinding mill, and the collector was used as shown in the table. A comparatively coarse grind was employed.

In each test one-half of reagent No. 404 was added at the beginning of the flotation period and the remaining half after five minutes. The Ammo Phos was added at the ball mill.

Table VIII—Composite Sample Ore Nos. 2 and 3

Reagents, pounds per ton.....	No. 404	1.0	1.5
	Ammo Phos	5.0	5.0
Time in minutes..... ...	Grind	15	20
	Float	15	15
Screen size.....	Plus 65 mesh, per cent	16.3	5.2
	Minus 200 mesh, per cent	43.4	49.7
Feed.....	Per cent lead	19.20	20.10
	Silver, ounces per ton	23.37	25.23
	Gold, ounces per ton	0.03	0.03
	Per cent "Insol."	54.60	53.00
Concentrates.....	Per cent lead	44.10	41.55
	Silver, ounces per ton	49.28	48.63
	Gold, ounces per ton	0.06	0.06
	Per cent "Insol."	17.40	19.90
Tailings.....	Per cent lead	2.35	2.12
	Silver, ounces per ton	5.89	5.49
	Gold, ounces per ton	0.01	0.01
	Per cent "Insol."	79.90	80.60
Per cent recovery in concentrate	Lead	92.7	94.3
	Silver	85.0	88.2
	Gold	80.2	83.5
	"Insol."	12.8	17.2

Conclusions

We have attempted to show that at least two problems are presented when an oxidized-lead ore is to be concentrated successfully by flotation: first a collector must be found that is capable of recovering the mineral desired, and, second, the pulp must be so treated that the collector can function effectively. Reagent No. 404 shows promise as a collector in the flotation treatment of oxidized-lead ores. For the ores and water used in these experiments, Ammo Phos was an effective conditioning agent.

We consider it altogether probable that a better and cheaper method of conditioning can be found than the one employed in these experiments. The conditioning agent employed must of course take account not only of the character of the ore but also of the water used in the flotation circuit. The method of conditioning must be worked out locally for the ore and water that are to be used.

Glory-Hole Mining of Limestone at Davenport, California

By GEORGE J. YOUNG
Associate Editor

ABOUT four years ago the operations of the Santa Cruz Portland Cement Company were described in *Engineering and Mining Journal-Press* (Aug. 15, 1925, Vol. 120, pp. 249-253). At that time the glory-hole method employed had been well started and underground development completed to the extent necessary. In April of the current year I visited the property again for the purpose of noting changes and improvements in methods and equipment.

Although about 500,000 tons of limestone is quarried each year, and the total amount produced during the last five years has totaled about 2,300,000 tons, the apparent dimensions of the wedge-shaped pit have not changed greatly. Slopes are flatter, and the quarry presents a clean, well barred-down appearance on both sides. The craters were drawn down, a practice which is followed during the winter months, and No. 1 glory hole has been coned down to within 30 ft. of the bulldozing chamber. Seven transfer raises have been driven and are in use.

As described in the aforesaid article, the 9x12-ft. haulage drifts are at 60-ft. centers, and the transfer raises 120 ft. apart. Each raise discharges into a bulldozing chamber, 80 ft. in length by 50 ft. in width, hopper bottomed, and connected with three chute raises on each side, the loading chutes serving the trains in the haulage drifts. Manway raises connect by intermediates with the transfer raises and are accessible from sublevels which also give access to the bulldozing chambers through short crosscuts. The plan of working was devised by Robert A. Kinzie and carried out by L. R. Davis, quarry superintendent, under Mr. Kinzie's direction.

The quarry of the Santa Cruz Portland Cement Company in April, 1929. Craters as shown are drawn down.

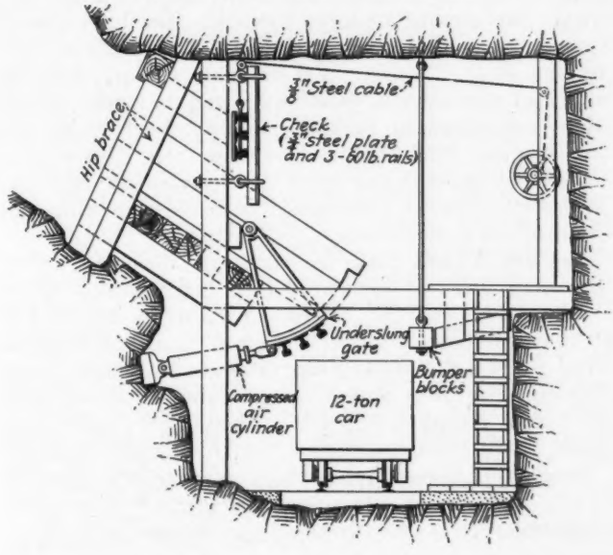
The original plan of working has been submitted to a five years' test, and mine and quarry operators will be interested to know what changes have been made as a result of this experience. In the spacing of the transfer raises, Mr. Davis said that the 120-ft. interval prevailing in the six transfer raises had been increased to 240 ft. in driving No. 7 raise. With the original spacing it was estimated that about 500,000 tons would be available to each transfer, but several have already exceeded this tonnage. This last raise broke through at a point 270 ft. above the haulage level, and commands a minimum

height of rock about 225 ft. above the top of the bulldozing chamber. On the haunches of the pit a considerable amount of limestone rock will be available before limiting slopes are reached. An approximate production of 2,000,000 tons from the west side and 1,000,000 tons from the east side of No. 7 transfer raise is estimated. The cost of the 270-ft. transfer raise, 300-ft. 9x12-ft. drift, a 5x8-ft. service raise to connect with south side of canyon, 200 ft. of 5x7-ft. manway raise, 300 ft. of 5x6-ft. intermediates, two chutes, and bulldozing chamber and surface clearing was about $26,000.

The size of the bulldozing chamber on No. 7 transfer was reduced to 40 ft. in length, other dimensions remaining the same. Instead of six chute raises, only two were constructed, one on each side. Corner loading chutes, designed to serve the bulldozing chamber when the center chutes are hung up, were found not to be especially needed. The dimensions of the main transfer raise have not been changed from the original sizes of 10 to 11 ft. square. Transfers do not enlarge, but the rock angles wear off and the sides become polished, so that after the initial period the transfer functions more efficiently than at the beginning. Bulldozing chambers have functioned satisfactorily, but, where transfers have been used on clayey material coming from the east end of the quarry, a tendency prevails for this material to mushroom out and sometimes to fill the bulldozing area. This is especially so during the winter months, when rainwater saturates the surface material and drains down to the transfer. Under such conditions hang-ups occur, as the clay is sticky when wet. Release of a hang-up causes mushrooming and the filling of intermediate connections. All workers are kept out of bulldozing chambers and intermediates at such times. The system of parallel raises and connecting intermediates to the transfers has proved to be the safest method for overcoming hang-ups, whether of rock or mixed rock and clay. Hang-ups at the chute gates are overcome by barring or by drilling oversize limestone pieces and blasting.

Blockholing of oversize rock can be accomplished at three points: (1) On the rock pile in the floor of the quarry, (2) in the bulldozing chambers, and (3) at the chute gates. The easiest way is to blockhole in the open, but this requires a certain amount of accumulated rock over the floor of the quarry, so that the rock blasted down from the sides can spread out and leave exposed the larger masses. In the winter season, however, little storage is carried in the quarry, and the pits are drawn down to a minimum, so as to afford rapid drainage. This arrangement increases the amount of bulldozing in the chambers and at the chutes.

Details of chute gates now in use



Loading chutes have functioned satisfactorily. Hand operation of the underslung chute gates was discarded, and two compressed air cylinders (5 in. in diameter, pistons 2 in. in diameter and 26-in. stroke) were placed at each gate. These enable the gates to be quickly operated and are an important factor in rapid loading. Two men are required to load, and they are sometimes assisted by the bulldozer. Chutes generally serve for the loading of 300,000 to 400,000 tons before repairs are required, but dry rot is now appearing, and timber replacement has become necessary. In the replacements some changes are being made.

The 12x12-in. hip brace, instead of bearing against the main post, has been increased in length and held at its upper end in a hitch cut in front of the hitch for the vertical post. Check gates have had to be strengthened. These are usually drawn to their top position and seldom touched thereafter. They slow down loading, but their use cannot be avoided. No doubt improvements can be made in providing a more suitable check. The underslung gate has also been strengthened, and heavier shackles are being installed when repairs are made. Sectors have also been increased in weight. Details of the loading chutes are shown in the accompanying sketch. In making repairs to chute structures at No. 1 glory hole, the crater was emptied and a bulkhead placed in the lower end of the transfer. The old timbers were then removed and the chute was rebuilt.

Breaking Practice

In an effort to reduce the amount of secondary blasting (blockholing) to a minimum, experiments were conducted in which spacing of drill holes, charging, and the use of different kinds of explosive were varied. Secondary blasting, however, could not be avoided, as some of the rock breaks into large pieces in spite of all expedients. Last summer, when no surplus rock accumulated, five machine drills for five months averaged 2,000 tons per day. The first year of operation the average per machine-drill shift was 350 tons; in 1927 the average was 489 tons, and in 1928 494 tons. In primary breaking, one pound of explosive accounted for 3.922 tons in 1926, 3.564 tons in 1927, and 3.355 tons in 1928. A marked tendency to use a greater proportion of explosive to rock broken is evident. This is reflected by the average loading per drill hole, which was 29.22 lb. in 1926, 32.47 lb. in 1927, and 34.18 lb. in 1928. Explosives used in secondary blasting in terms of pounds per ton loaded were: 0.0501 in 1926, 0.0458 in 1927, and 0.0638 in 1928. Total explosive in pounds per ton was: 0.3051 in 1926, 0.3258 in 1927, and 0.3618 in 1928. Apparently, the increased toughness of the rock and the increased weight of explosive required are explained by the fact that the quarry face has penetrated to greater depths where the rock has undergone less action from weathering influences.

Drilling machines have been changed. The hand-held machine used formerly weighed 45 lb., and was apparently satisfactory under intermittent drilling operations. In summer campaigns, however, when two or three places were arranged for drilling, so that as fast as one was drilled the drills and drillers were moved to the next place and a whole shift was applied to drilling, the vibra-

tion of the machine and resultant jarring of the drillers in this continuous service proved to be objectionable. A heavier machine—the Gilman AR 221, weighing 65 lb.—was introduced, and has, after several years' use, proved to be better adapted to the conditions. Less vibration has removed the difficulties caused by continuous drilling.

In operations of the first two years, quarry workers were divided into two groups, the faster men being placed on drills and the slower on the blasting crew. A better balance of operations was secured by reversing the picture, the slower men being placed on drilling and the faster on the blasting squad. The longest drill steel used is 21 ft., and the deepest hole drilled is 20 ft., with $1\frac{3}{8}$-in. bottom diameter. Holes are chambered twice, the springing charge being about five and a half 1x8-in. cartridges of 60 per cent straight nitroglycerine dynamite. Holes are blown out with compressed air and loaded to within $1\frac{1}{2}$ or 2 ft. of the top. Stemming is used, as well as electric exploders. Fuse is used only in blockholing. As the holes are sprung and air-blown in sequence, an ininterval of about a half hour intervenes before the second loading for chambering, and a similar interval before final charging. In bringing compressed air to the drill manifolds, 2-in. rubber hose of heavy construction has been found to meet satisfactorily the conditions of the quarry.

A systematic accident-prevention plan is in operation, and, as a result, only five lost-time accidents occurred in 1928. Goggles are worn by the men in the bulldozing chambers, when blowing out drill holes, and at the loading chutes, where, at certain seasons, dust is experienced. In the quarry, goggles have been found to impair vision, and, as a consequence, they are not worn except when blowing out drill holes. A feature of the quarry operations is the thorough way in which the steep slopes of the quarry are kept cleaned down. This applies also to the craters when coming down.

No changes have been made in the transportation equipment. Broken axles and journal pedestals are the extent of repairs made on the cars. From four to six

Tool carrier used to lower drills from upper bench to quarry pit

axles are broken per year, the number of twelve-ton cars in service being 63 to 64. Few or no repairs are made on the trolley locomotives, which are overhauled each year. Storage-battery locomotives used underground have given excellent service; two batteries of Exide cells have been in service more than five years. About 700 cu.ft. of free air per minute at 97-lb. pressure is used. One compressor has been replaced.

At the time of my first visit to the quarry stripping operations were in progress on the north side, but these were discontinued in 1926. Since that time, the north side has reached a point where further stripping will be necessary in the near future. The south side has been cleared of timber growth and made ready for operations. Quarrying of a mixed limestone and clay product in part of the quarry has proved advantageous in providing part of the clay requirement of the cement plant, but when the clay is wet, difficulty in handling arises at loading points, transfers, and in the rock-crushing division of the plant.

Domestic Quicksilver Production Increased 50 per Cent in 1928

PRODUCTION of mercury in the United States in 1928 amounted to 16,838 flasks (75 lb. each), according to the U. S. Bureau of Mines. The calculated value of the production, using the average price of mercury during the year, is $2,052,215. This is the largest domestic production since 1919, when 21,415 flasks, valued at $1,933,560, was produced, but is only approximately half as large as the average annual production for the period, 1850-1921. Production in 1927 was 11,276 flasks, valued at $1,314,782. The average quoted price at New York for 1928, $123.506 a flask of 76 lb. (*E.&M.J.*), is the highest ever recorded, with the exception of the average prices in 1916 and 1918.

As usual, the largest production of any state was that of California, with 6,711 flasks. Nevada produced 2,905 flasks; Oregon, 2,848 flasks; and Texas, Washington, and Arizona, together, 4,374 flasks. In addition to the above, 404 flasks of mercury was produced in Nevada from gold and silver pan-amalgamation tailings, compared with 226 flasks from this source in 1927.

The principal producing mines in 1928 were the Sulphur Bank, Lake County; Knoxville, Napa County; New Idria, San Benito County; Oceanic, San Luis Obispo County; and Cloverdale, Sonoma County, all in California; B & B Quick in Esmeralda County, and the mines of the Nevada Quicksilver and Pershing Quicksilver companies in Pershing County, in Nevada; the Opalite mine, Malheur County, Oregon; the Chisos mine, Brewster County, Texas; and the mines of the Barnum-McDonell Mercury Company and the Morton Cinnabar Company in Lewis County, Washington.

In 1928, 15,583 flasks of mercury, valued at $1,572,017, were imported, compared with 24,650 flasks, valued at $2,189,495, in 1927. Of the 15,583 flasks imported in 1928, 6,189 flasks were derived from Spain, 5,718 flasks from Italy, 1,816 flasks from Mexico, 913 flasks from Belgium, 546 flasks from Germany, and 401 flasks from the United Kingdom. In 1927, 13,663 flasks came from Spain, 9,089 from Italy and 1,898 from other countries.

Production in the United States plus imports indicated 32,421 flasks made available for consumption in 1928, compared with 35,926 flasks made available in 1927.

A Statistical Study of Copper Production and Consumption

THE ACCOMPANYING STATISTICS *of the copper industry in recent years are comprehensive, enlightening, and of timely interest. They represent a special compilation of the American Bureau of Metal Statistics, which doubtless will become an annual feature of the statistical service of that organization. Table III is particularly interesting. Many items in this table are of significance even to those only cursorily interested in the industry. Increasing consumption of copper in the automobile and building industries is well known, of course. However, one cannot but be astounded upon realization of the amount of copper consumed in such relatively insignificant items as safety razors, automobile brake linings, plated ware, clocks and watches, and various other products of industry. Also, the potential consumptive possibilities of such uses as "steam railways electrified," copper-bearing steel, heating radiators, and other items that are as yet relatively unimportant, presage continued prosperity for the copper industry.*

IN TABLE I the copper production of the world is given in three ways: namely, as attributed to the mines of origin (which states the production of virgin copper); to the places where smelted; and to the places where refined. These statistics are summarized in the first table, following, wherein the figures are given in units of 2,000 lb., which unit is used uniformly in the other tables in this report. These statistics for several years previous to 1928 have been revised, but the revisions have been small and have no material effect upon previous deductions.

Table I—Summary of World's Copper Statistics

	1925	1926	1927	1928	Per Cent Increase (a)
Mine	1,589,717	1,634,193	1,681,634	1,883,422	12.00
Smeltery[1]	1,565,612	1,631,652	1,694,142	1,900,368	12.17
Refinery	1,601,208	1,705,976	1,765,720	1,956,621	10.81
Consumption	1,683,200	1,734,800	1,777,300	2,024,300	13.90

(a) 1928 over 1927.

Classified Production Totals

	1926	1927	1928
Electrolytic	1,442,718	1,498,398	1,682,994
Furnace-refined	263,258	267,322	273,627
Totals	1,705,976	1,765,720	1,956,621

Under the head of furnace-refined is included the copper produced by the Lake Superior works, the copper that is produced and sold as bessemer, and the black and blister copper that is refined by furnacing, the quantity of the last now being very small. It is noteworthy that the increase in the world's production of refined copper occurs mostly in the electrolytic form.

The totals of production on mining and smelting bases should be in substantial agreement, as indeed they are. Discrepancies are ascribable to certain statistical difficulties, and differences in timing. Some of the copper produced in ore appears in the form of matte and cement copper and consequently never figures as blister copper. Some secondary copper resulting from the smelting of junk enters into the reported production of blister copper.

Statements of production on the mining and smelting bases are most valuable in showing where the copper originates and the progress in the several producing regions. The production reported on refinery basis always exceeds the production reported on the smelting basis, notwithstanding that a small portion of the copper in blister is recovered as copper sulphate, for the reason that a considerable proportion of secondary copper enters into refiners' production, both electrolytic and fire-refined. This occurs to the largest extent in the production of America and Germany. The statistics for Russia inferentially evince the same thing. A considerable quantity of secondary copper is produced in the United States that is not statistically reported, and the same condition doubtless obtains in Europe.

Reconciliation between smelting and refining production is also confused by the condition of accumulation or depletion of stocks between the two positions, in respect of which information exists as to North and South America but not elsewhere.

These explanations illuminate the dangers in attempting a meticulous analysis and co-ordination of the statistics. The American Bureau of Metal Statistics considers the statistics showing mine production to be the most important in their revelation of the supply of new copper, whereas the refinery statistics are the most important in showing the supply that is made available for market.

The computation of world's consumption is made on the conventional basis of production plus imports minus exports in the instance of each country, with allowance for plus or minus in stocks when such data are available. Some countries, in reporting their imports and exports, do not discriminate between crude and refined copper, and consequently full uniformity in computation is impossible. In the main, consumption is calculated on the basis of production of refined copper, and therefore comparison should be made with that line of production data rather than those for smeltery or mine production. Even so, the correlation is not perfect, for undoubtedly some secondary copper figures in imports and exports without appearing in production in respect of some of the countries.

In Table II is summarized the production of copper in the several stages, and the consumption, by countries. This shows in a broad way the physical movement of copper between the mines of origin and the places of ultimate consumption, or rather of manufacture; for a considerable part of the copper that is accredited as being consumed in certain countries is subsequently exported from them in the forms of rods, wire, sheet, tubes, and more highly fabricated articles.

The statistics for several countries of Europe have to be reported in an aggregate in order to avoid disclosing

[1]Mr. W. R. Ingalls, director of the American Bureau of Metal Statistics, advocated the use of the term "smeltery"—to refer to the plant as distinct from the operator—when editor of *Engineering and Mining Journal*. The term is a logical one, and its use thus is supported by the standard dictionaries.—Editor.

Table II—Copper Production and Consumption of the World

In Tons of 2,000 Pounds

	1927				1928			
	Production				Production			
	Mine	Smeltery	Refinery	Consumption	Mine	Smeltery	Refinery	Consumption
United States	847,419	965,887	1,257,445	825,200	935,199	1,060,568	1,370,053	983,500
Mexico	63,760	43,925	.....	.....	72,579	50,577	.....	.....
Canada	70,698	35,625	9,261	17,200	96,634	62,046	8,902	19,200
Cuba	15,538	.....	.....	.....	18,869	.....	.....	.....
Bolivia	7,850	.....	.....	.....	7,500	.....	.....	.....
Chile	264,242	247,422	210,616	.....	319,549	305,855	248,582	.....
Peru	52,695	50,958	.....	.....	57,830	57,697	.....	.....
Venezuela	150	.....	.....	.....	.....	.....	.....	.....
Austria	3,968	3,968	3,968	18,600	3,638	3,638	3,638	20,800
France	*2,612	*2,612	(a)	99,900	*2,535	*2,535	(a)	138,600
Germany	31,526	58,312	115,299	292,400	26,455	53,462	113,206	279,700
Great Britain	.....	17,086	(a)	173,900	.....	19,841	(a)	177,500
Jugoslavia	14,220	14,220	.....	(a)	16,629	16,629	.....	(a)
Norway	13,227	15	(a)	(a)	14,475	868	(a)	(a)
Russia	*13,227	*13,227	24,169	48,500	*14,330	*14,330	26,300	55,600
Spain and Portugal	60,351	26,097	(a)	14,100	59,427	22,828	(a)	16,400
Sweden	.....	5,958	(a)	20,000	1,000	3,743	(a)	23,800
Other Europe	3,400	10,000	46,704	152,800	3,400	10,500	88,421	192,100
Japan	73,381	73,381	73,381	83,600	72,796	72,796	72,796	88,100
India	5,100	.....	.....	(b)	4,600	.....	.....	(b)
Other Asia	2,000	2,000	.....	9,100	2,000	2,000	.....	9,400
Australasia	12,800	10,983	10,712	9,900	12,846	10,917	11,860	7,500
Africa	123,470	112,466	14,165	12,100	141,131	129,538	12,863	*12,100
Totals	1,681,634	1,694,142	1,765,720	1,777,300	1,883,422	1,900,368	1,956,621	2,024,300

(a) Included in "Other Europe." (b) Included in "Other Asia." * Conjectural.

the business of individual refiners, several of these countries having only one or two plants. The new refinery at Oolen, in Belgium, was in operation during 1928, this being the most important addition to the refining capacity of the world.

The copper consumption of the world increased in 1928, as compared with 1927, in a greater rate than the increase in refinery production, implying a depletion of stocks, which is known to have happened. The increase in deliveries in the United States in 1928 was a little more than 19 per cent, and thus materially above the world rate.

In Table III is given the American Bureau of Metal Statistics estimate of the consumption of copper in the United States according to industries. This table is compiled from reports from the several industries themselves in respect of their use—not from any attempt to allocate deliveries among them. Consequently, the two totals arrived at in opposite ways are not to be expected to agree; nor is the same accuracy to be expected in the total by use as in the total by delivery, for the reason that there are so many more factors to be taken into account.

The American Bureau of Metal Statistics believes that the grand total by use tends to be an understatement, owing to inevitable omissions. However, the total by use shows approximately the same increase in the rate of consumption in 1928 compared with 1927 as the total by delivery.

It is worthy of remark that the American Bureau of Metal Statistics' accounting of the use of copper in building is less than other estimates of that use that have been made. The explanation of this is mainly that electrical equipment is not included under this head, but is assigned to electrical manufactures and to wire and rods not elsewhere specified.

Table III—Estimated Copper Consumption of the United States

In Tons of 2,000 Pounds

	1926	1927	1928
Electrical manufactures (a)	201,000	196,500	213,000
Telephones and telegraphs	104,000	93,000	119,000
Light and power lines (b)	122,000	103,000	115,000
Trolley wire	7,000	5,300	6,300
Wire and rods n.e.s.	74,000	49,000	80,000
Wire cloth	7,000	5,400	6,500
Steam railways electrified	400	750	800
Automobiles (c)	102,800	99,000	125,000
Automobile brake lining	1,700	1,800	2,400
Buildings (d)	50,200	52,800	62,000
Locomotives	2,900	1,900	1,100
Railway cars	6,150	4,500	3,200
Air brakes	2,000	1,600	1,300
Ships, commercial (d)	2,100	3,600	1,600
Ships, naval (d)	400	2,400	300
Bearings and bushings	38,000	41,500	42,000
Valves and pipe fittings	26,000	21,000	20,500
Ammunition	5,700	4,600	8,200
Lubricators	5,000	4,700	5,000
Condensers	2,000	1,600	1,900
Fire-fighting apparatus	2,700	2,500	2,300
Agricultural machinery	1,100	1,300	1,500
Cash registers	400	300	400
Copper-bearing steel	1,350	1,600	1,600
Coinage	950	850	800
Radio receiving sets	5,000	4,500	5,100
Clocks and watches	4,500	5,000	4,600
Washing machines (d)	5,000	3,800	4,200
Water heaters, household	4,000	3,000	2,600
Water meters	3,750	3,500	3,500
Refrigerators, electric (d)	15,000	15,800	13,200
Plated ware	8,000	5,500	7,000
Safety razors	2,200	1,900	1,500
Radiators, heating	700	850	1,100
Other uses	45,000	41,000	50,000
Manufactures for export (e)	49,900	56,100	65,600
Totals	909,900	841,450	980,100

(a) Generators, motors, switchboards, and lamps, but exclusive of manufactures for telephone and telegraph purposes. (b) Transmission and distribution wire and busbars. (c) Does not include electrical manufactures. (d) Does not include electrical generators, motors and similar products. (e) Includes all primary fabrications of copper and its alloys.

White Sands of Tularosa Basin

WEST of Alamogordo and Tularosa, in southern New Mexico, is a great deposit of white granular gypsum known as white sands. According to N. H. Darton, in Bulletin 794 of the U. S. Geological Survey, the deposit is 27 miles long from north to south and averages about 10 miles wide, although for some distance northwest of Alamogordo its width exceeds 13 miles. The total area is fully 300 square miles. Its thickness averages possibly 50 ft., and much of this material contains no more than 2 or 3 per cent of impurity. The tonnage may be roughly estimated at 13,000,000,000, by calculating the weight of gypsum sand at 60 lb. to the cubic foot.

Toward the north this deposit merges into a quartz sand, also in dunes that occupy an area of about 20 square miles. This gypsum is believed to be largely derived from chemical deposition in lakes in the basin, which is an inclosed one, but much of it has been brought to the surface by ground waters "through processes in some respects similar to those involved in the formation of caliche," and it has been heaped into eastward-moving dunes by wind action.

Differential Grinding

Applied to Tailing Re-treatment

THE consulting engineer of the Missouri-Kansas Zinc Corporation, C. Erb Wuensch, noted the difference in the type of tailing from upper-level and lower-level ore. The latter contained hard lime chats. He also found that mill losses had been caused by particles of blende on the corners or sides of the chats and by the existence of soft, porous, cellular, lime chats containing varying amounts of blende. He conceived the idea that a quick grind in rolls or ball mills might change the type of the material so that jigging could make a clean tailing for discard and a partly concentrated product sufficient in blende content to justify the expense of fine grinding in ball mills to free the mineral entirely. A laboratory was equipped and L. M. Banks and G. A. Johnson, manager and metallurgist, respectively, for the company, were assigned the problem of developing a method of re-treating the tailing. The results are given in Technical Publication No. 217, A.I.M.E., which is to be discussed at the San Francisco meeting in October, and a résumé follows:

In the laboratory testing to develop a method of treating Waco tailing, it was found that:

1. Gravity methods of concentration were unsuitable on the raw material.

2. Differential grinding in ball mills created an enrichment in the finer sizes and an impoverishment in the larger sizes.

3. Screening of the discharge of the ball-mill product allowed a discard of about 50 per cent, by weight, of the coarse material, thus giving a preliminary concentration and avoiding fine grinding of the entire feed.

In the commercial mill, built to test the principles developed in the laboratory, it was found that:

4. Differential grinding in ball mills under operating conditions closely approximated laboratory results.

5. Costs of differential grinding were materially lower than fine-grinding costs, because of:

(*a*) Large capacity of a given size of ball mill on this type of grind as compared to fine grinding. The capacity of a 6x4-ft. mill is 7 to 10 tons per hour on fine grinding, and 25 to 30 tons per hour on differential grinding.

(*b*) Low iron consumption per ton treated.

The product resulting from differential grinding gave an oversize, after screening, suitable for immediate discard, and an undersize readily amenable to tabling and jigging. The oversize discard was 27 to 32 per cent of the total tailing. In the laboratory tests the discard was taken as +14-mesh material. In the actual operation the discard screen analysis is: 23.5 per cent on 4-mm. and 41.9 per cent on 8-mesh. This compares with 27.60 per cent of +4-mm. or 39.85 per cent of +8-mesh. Slime produced from the tailing mill was quick-settling and made excellent flotation feed, from which a clean concentrate and a low tailing could be made.

The total cost of ball milling when the tailing mill is handling 50 tons per hour of new feed is 8.15c. per ton, to include labor, power, balls, liners, grates and miscellaneous supplies. Actual operating expenses in cents per ton comprise reclaiming and hauling, 7.11; total milling, 1.08; flotation, 9.66; total operating cost per ton of tailing, 27.57; liability insurance, 0.52; assaying, 0.25; underground pumping, 0.67; fire and tornado insurance, 0.66; general expense, 2.22; total cost, 31.89.

The operating expenses were based on treating 243,805 tons of feed in the tailing mill, of which 53,395 tons were sent to the flotation plant as slime.

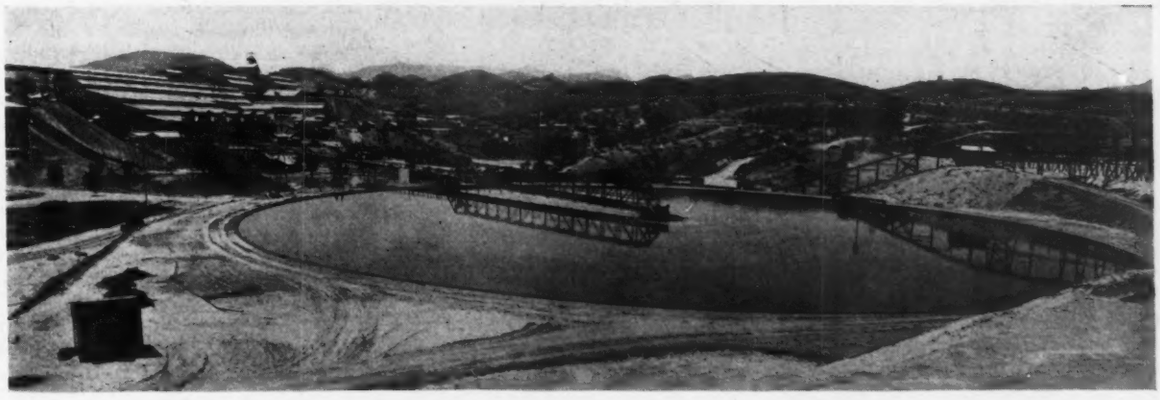
U. S. Now Producing 15 Per Cent of Its Potash Requirements

POTASH produced in the United States in 1928 amounted to 104,129 tons of potassium salts containing 59,910 tons of potash (K_2O), according to the U. S. Bureau of Mines. Sales by producers were valued at $3,029,422, f.o.b. plants. About 6,260 tons of potassium salts, with an available content of 2,100 tons of K_2O, remained in producers' stocks Dec. 31, 1928. The output increased 35.5 per cent in gross weight, with an increase of 38 per cent of K_2O content.

Production was chiefly from natural brines in California and distillery residue from molasses in Maryland. Small amounts were also obtained from steel plant dust in Pennsylvania and Virginia, and Steffen's water in Indiana. A small amount of alunite was shipped from Marysvale, Utah, but it was not utilized other than for experimental work.

The potassium salts imported for consumption into the United States in 1928, according to the Bureau of Foreign and Domestic Commerce, amounted to 975,661 tons, containing 330,000 tons equivalent K_2O.

A thickener with an area of almost two acres. The Dorr tractor unit of Miami Copper, at Miami, Arizona



COST-CUTTING INNOVATIONS

Square Bends in Air Ducts Save Power

THE purpose of an elbow in a duct is to change the direction of flow. To do this most efficiently, the bend should offer the least impedance, the major causes of which are turbulence, surface friction, and restriction of flow area. Each of these factors reduces the available static pressure and therefore the work capacity of the air. By proper design of the bend, these dissipative conditions can be almost eliminated, according to B. L. Spivak, in *Power*.

The jets *A* and *B* in Fig. 1 are both directed against similar curved surfaces. Jet *A* strikes the steeper portion of the curved surface and is changed in direction with practically no turbulence. Jet *B* strikes the flatter portion of the surface and breaks up into currents moving in all directions. Inasmuch as the portion moving in the required direction is less than the original jet, this method of diverting flow is wasteful. A curved surface is the most efficient in diverting a jet when the direction of the jet at the point of impact is parallel to the tangent to the surface at that point. Surface friction is less in jet *B* than in jet *A*, because the velocity of the induced currents, in contact with the curved surface, is lower than the velocity of the normal flowing air. Nevertheless, the energy loss caused by turbulence and the scattering of the jet in all directions more than outweighs the reduction of surface friction.

Consider the flow of air in an ordinary elbow as shown in Fig. 2. The volume can be considered as comprising several contiguous jets of minute depth and of a width equal to that of the elbow. The jets nearer the outer curve change in direction with but little disturbance, but those nearer the inner curve, on striking the stream near the top of the bend, create currents directed toward and against the flow and toward the sides of the duct. However, the effect is not so pronounced as in jet *B*, Fig. 1, because the normal air flowing assists in turning that portion of the air nearer the inner curve. The currents directed toward the sides, on striking them, also break up into component currents. Disturbances thus produced are concentrated in the upper portion and along the sides of the elbow. The effect of the air layer near the outer radius is to move the zone of turbulence nearer the elbow outlet. As a result, the area of flow is reduced and a serious loss is introduced.

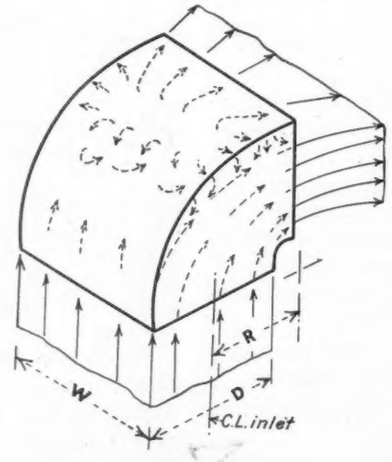


Fig. 2—Air currents set up in an ordinary elbow

Fig. 3 shows the air distribution in a square elbow. Little more turbulence occurs with this kind of bend than with an ordinary one, but the component currents moving against the normal flow reach the quiet zone immediately under the corner. The remainder of the air stream sweeps by this zone, and as there is more area at this point, less of the flow area is affected. This improves the efficiency of the bend.

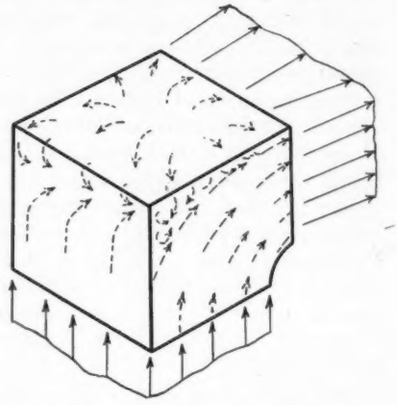


Fig. 3—Air currents set up in a square turn

In general, the efficiency of bends depends on the relation between the dimensions of depth *D*, width *W*, and radius *R*. The ratio *W/D* is known as the aspect ratio, and *R/D* as the radius ratio. Experiments have shown that bends of an aspect ratio of about four are best. With a duct width of four times the depth, the currents moving toward the sides are for the greater part absorbed before they reach the sides. The turbulence near the sides affects a relatively smaller area of the flow, resulting in improved efficiency. With aspect ratios greater than four, the increased area of contact between air and duct increases the surface friction, whereas with aspect ratios of less than four, the disturbances at the sides penetrate farther into the flow area. Both conditions reduce the efficiency considerably. Also, for best results the bend should have a radius ratio of at least six. Then almost the whole jet strikes the steeper portion of the curve and little turbulence results. From the foregoing it follows that a large-radius bend of pronounced rectangular cross-section is best adapted to change the direction of flow. In a straight run of duct the greatest loss is occasioned by surface friction. Inasmuch as a prism of square section has the lowest ratio of surface area to volume, this section has been generally adopted for straight runs. Extension of such a section to bends was due to the failure to analyze the nature of the losses involved in each case.

The large volumes handled by ducts, especially in forced- and induced-draft

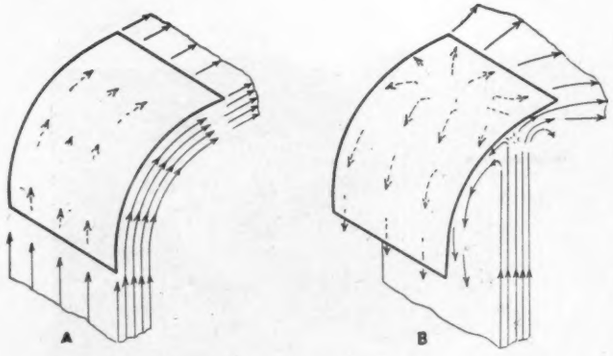


Fig. 1—What happens when an air jet impinges on a curved surface

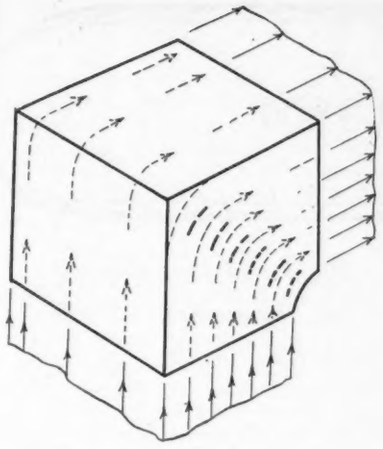


Fig. 4—Vanes in a square turn improve efficiency of the bend

systems, and the restricted space available make it impossible to install bends of the form treated herein. But by adding blades in a square elbow, as shown in Fig. 4, any bend can be made to give the highest efficiency. An inspection will show that the elbow is really equivalent to several contiguous bends of high aspect and radius ratios. This results in a minimum turbulence and flow-area reduction. The blade area is made small compared to the duct dimensions, so that surface friction is but slightly increased. This form of bend, therefore, satisfies all conditions for highest efficiencies, and its application may reduce losses by as much as 80 per cent.

Nine Mechanical Units Replaced by Two

ADDITIONAL INFORMATION has been received concerning the changes being made in the coarse-crushing plant of the Morenci concentrator of the Morenci branch, Phelps Dodge Corporation. The objectives of the changes are increase in capacity and lower operating cost. Lower cost is to be obtained by reducing the number of crushing stages in breaking run-of-mine size to ¾-in. size, from four to two stages, and it is also expected that a finer size will result from the new arrangements.

Run-of-mine ore at Morenci has a maximum size of 18 in. Present practice in coarse crushing involves the following: No. 1, a 36x48-in. Chalmers jaw crusher breaking to 6-in. size; No. 2, a No. 8 McCully gyratory crusher to 3-in. size; No. 3, two Symons horizontal disk crushers to 1¼-in. size, and No. 4, two slow-speed, 54x24-in. P. & M. rolls breaking to ¾-in. size. In the new plan, Nos. 2, 3, and 4 will be eliminated and in their place will be one pass through a 7-ft. Symons cone crusher, which it is estimated will reduce the 6-in. maximum size to approximately ½-in. size at the rate of about 270 tons per hour. Two of the 7-ft. Symons cones will be installed to work in parallel, but it is thought that one crusher will answer requirements for the greater part of the time.

The new flow sheet that will be used is as follows: Run-of-mine from hoist bin will pass over a short grizzly (4-in. spacing) to the 36x48-in. jaw crusher. Grizzly undersize and crusher product will discharge to No. 1 conveyor, which delivers to a Traylor vibrating screen, and minus half-inch size is separated, the products being received in three surge bins, a central undersize bin, and an oversize bin on either side. Three pan conveyors will be used to unload the surge bins, the undersize going to No. 2 conveyor and thence to the fine-ore storage bins. The oversize pan conveyors will discharge directly into the two Symons cone crushers, the crusher product being received on No. 2 conveyor and delivered to the fine-ore bins. In the secondary crushing plant four 43x16-in. rolls will be eliminated. The changes thus make possible the removal of nine mechanical units and their replacement by two. This in turn had been made possible by the greater reduction that can be made by one pass through the cone crushers.

Oven for Baking or Drying Electrical Equipment

CONSIDERABLE saving has been effected by the Utah Copper staff by the use of an oven for baking the varnish on armatures and moisture out of motors. This oven, constructed of firebrick, measures 7x8x8 ft. It is shown in the illustration. A steel door

An oven for baking varnish on armatures and kindred other purposes

of ¼-in. stock, 3 in. thick packed with Sil-O-Cel insulating powder, forms the entry. Parts are wheeled into the oven on a car. Six banks of strip heaters arranged in series of four, each with a capacity of 2,000 watts, give a total of 12 kw. available for heating purposes, and provide for the increase of the temperature of the oven to 101 deg. C. in one hour. The average heat used is slightly below the boiling point.

Prevention of Ice in Tunnel Reduces Labor Expense

THE Slocan Star mine of the Silversmith Mines is situated near Sandon, British Columbia, at an elevation of 4,000 ft. above sea level. For five months in winter the temperature varies from extremes of 20 deg. below zero to 40 above, the ordinary range being from zero to 20 above, according to Clyde B. White, mine superintendent.

The main working adit is a crosscut tunnel, 2,100 ft. long, intersecting the vein 1,200 ft. below the outcrop, with which it is connected by continuous workings. In cold weather a strong current of air blows in at the portal of the adit. This draft was originally controlled by a single door at the portal, but could not be shut off entirely, as it was necessary to open the door to permit passage of ore cars, and a certain amount of leakage was constantly required to ventilate the workings.

Surface water dripping from the roof along the first 300 ft. of the crosscut in winter formed ice, which rapidly built up, and, unless chopped away, soon prevented passage of the ore cars. During very cold weather a man on each shift was required to keep the tunnel clear.

To avoid this cost, 12-in. diameter ventilating pipe was laid in the first 400 ft. of the tunnel, beginning just outside the first door, and a second door was placed at a convenient point past the inner end of the pipe. The results were even better than anticipated. As the two doors are not open at the same time, there is never a strong draft. Very little leakage occurs at the first door, as almost all the air required is drawn through the pipe. The wet portion of the tunnel remains much warmer, and so little ice is formed that it requires to be cleaned out only about once a month.

Forget the Age of Equipment

In a table entitled "Economical Life of Machinery," just issued in a British yearbook, the useful life of machine tools is listed at twenty years. This statement, unfortunately, is significant of the attitude of many machine users in this country as well as in Great Britain, and is responsible for much economic waste.

What is meant is that the physical life of a machine may be twenty years, but the economic life of a production unit cannot be measured in terms of time or by its physical condition. Its life should end whenever another machine or method has made it possible to produce at a lower net cost, regardless of the age of the machine or its physical condition.

Forget the age of a machine or its physical condition, recommends the *American Machinist*, from which the above is taken. Think only of how the cost of its product compares with that of the best machine available. That, and that alone, determines the economic life of equipment.

COMMENT AND CRITICISM

The Mining Engineer's Definition of Ore Questioned

To the Editor of "E.&M.J.":

In searching for a name for the borderland material between ore and waste, I believe you are fundamentally wrong in defining ore as mineralized material that can be mined or mined and treated at a profit. At what profit? One looks for, say, 10 per cent return in mining ventures, but if the profit is less than 10 per cent when does the ore cease to be ore? According to the foregoing definition it must be when the capital invested gives no return. A change in the management, however, may remedy this until profits again vanish, when the market price of the metal produced falls a few points. Examples may be given *ad nauseam* and tend to make such a definition ridiculous. I maintain that the exploitation of ore may be either payable or unpayable, depending on many factors entirely outside the quality of the ore itself. Why not, therefore, call the material under discussion unpayable or unprofitable ore? These names have stood the test of time and express exactly what is meant.

F. H. JACKSON.

Sydney, N. S. W.

[Mr. Jackson's contention regarding the definition of ore brings up a subject that was threshed out ten and fifteen years ago. From that discussion, there came the so-called mining engineer's definition—that ore is material that can be mined, treated, and sold at a profit, or, as Mr. Jackson might assert, on a payable basis. This definition has been accepted almost universally. The various arguments and respective merits of the different definitions are matters of record; to us there appears to be nothing that may be gained by reopening the subject at this time. Though Mr. Jackson opposes the mining engineer's definition of ore, he proposes no substitute. This renders impracticable his suggestion in regard to "unpayable or unprofitable ore," because, lacking a satisfactory definition of ore, we cannot define a product that is related to ore on the basis of such a relationship. Then, too, if the material under discussion may be defined as "unprofitable," in contradistinction, presumably, to "ore," which is "profitable," we have completed the circle and are back where we started.

The problem to which Mr. Jackson refers may be summed up as follows: Under the dictionary definition of ore, no need exists for a separate classification of the material that *E.&M.J.* proposes to call "junore." Under the mining engineer's definition of ore, a line of demarcation must exist between ore and junore, and to make that flexible line of demarcation largely contingent upon the profit factor seems logical and reasonable. Obviously, the profit factor must rest on many conditions other than the unchanged analysis of the product. The fact that a given deposit may be ore under one set of conditions and junore under other conditions impresses us with the need for a precise terminology, and the soundness of the "profit" definition.—EDITOR.]

Domestic Graphite Producers Ask Increased Tariff

To the Editor of "E.&M.J.":

In the non-metallic mineral price section of the *E.&M.J.* of May 4, under "Graphite," you mention that some of the trade factors feel that the tariff agitation is only in the interest of promoters. On the other hand, the people who are asking for the increase in the tariff rate are, so far as I can determine, people that are actively interested in graphite production, particularly of the crystalline variety. We are asking for an increase in the rate owing to the fact that foreign competition has kept us practically inactive since the opening of our deposits, which are productive of a small flake crystalline type, with high graphitic carbon content.

As to some of the other operators in this part of the country, the Superior Flake Graphite Company is operating at Ashland, Ala., even though the market is very unsatisfactory to it. L. H. Weller, of Birmingham, represents those who are reorganizing and planning to operate the old National Graphite Company, of Alabama, and they should become large producers. The Southwestern Graphite Company, of Burnet, Tex., is probably the only other southern producer. That is only a small percentage of the fifty or sixty original operators.

Another man who is working for the increased tariff is State Senator Pearl I. Smith, of Montana, who is with the Crystal Graphite Company, of Dillon, Mont.

Dealers of course minimize the necessity of the tariff, as only certain grades produced in the United States would go through their hands. Much could be sold direct to the consumer, whereas the imported material is customarily sold through a broker.

PORTERFIELD GRAPHITE MINES,
by Joe Porterfield.

Royston, Ga.

Electrical Prospecting for Assessment Work

To the Editor of "E.&M.J.":

Enclosed herewith is copy of a letter recently obtained from the Hon. G. S. Harrington, Minister of Mines for the Province of Nova Scotia, which is self-explanatory. It should prove of interest to your readers. E. H. GUILFORD,
General manager,
The Radiore Company of Canada,
Montreal, Canada.

Minister of Public Works and Mines,
Nova Scotia
Halifax, Nova Scotia,
May 27, 1929.

E. H. Guilford, Esq.,
General Manager, The Radiore Company of Canada, Ltd.,
Montreal, Canada.

Dear Sir:

For the years 1929 and 1930 we will accept electrical prospecting upon mineral properties in Nova Scotia to count against the compulsory work provisions of our Mines Act when that service is carried out by a reliable firm. The allowance will be made on the basis of the total charges for the service to represent employment of men at the rate of $5 per day.

The foregoing allowance, however, is entirely subject to the provision that full copies of any reports made upon such survey, together with copies of maps or other data supplied as a result of it, shall be filed as soon as completed with the Department of Mines of this province, properly certified by the chief engineer of the company carrying out the survey. Yours faithfully,

G. S. HARRINGTON.

Synthetic Producers Seek Market for Ammonia

To the Editor of "E.&M.J.":

During the last decade, many patents have been issued for the use of ammonia in metal extraction. At the time of the invention, they were considered impracticable because of the high cost of ammonia. Until comparatively recently this was true, but suddenly the picture has changed, and for the last few years ammonia has been a very reasonably priced chemical. The large synthetic nitrogen installations recently started up have thus added a new commercial alkali. Ammonia is now lower in cost than caustic soda (on a chemically equivalent basis). This fact is known by relatively few, and it is suggested

that a fertile field for experiment and research lies ahead. Anyone who will review some of the older patents, abandoned because of the high cost, will find a great number of uses suggesting themselves. Leaching, neutralizing, hydrolysing, and reducing are only a few of the examples which come to mind. A. GEORGE STERN.

New York, N. Y.

Defining Borderland Material

To the Editor of "E.&M.J.":

Regarding the name sought for the material between ore and waste, I would point out that in the "Coal and Metal Miners' Pocket Book," published in 1904, in the "Glossary of Mining Terms" on pp. 565-622, the following names for the material in question can be found:

Raffain—Cornish—Poor ore.

Desmontes—Spanish—Poor ores.

Despoblado — Spanish — Ore with much gangue.

Low-Grade—Not rich in mineral.

Coarse (loose)—When lode stuff is not rich, the ore being only thinly disseminated through it.

In this list there should be a term that no mining man could mistake the meaning of. GEORGE H. BODFISH.

Malheur, Ore.

[Curiously enough, our correspondent's letter arrived as if in answer to a suggestion made by another Western reader, who wrote, *inter alia*, as follows: "We are getting a great kick out of the struggle to find a name for the might-be ore. As we were winding up the day's work we thought that out of the following, one might be taken—to stimulate the minds of others and bring out the right word. Here goes: ifite, hopeite, paleite, paylight, doubtite, subite, maybeite, forlornite, sadite, futurite, midite, romancite, insipidite, whenite, and whereite. I'll bet, at that, the old Cousin Jack has a perfectly good Cornish word for this stuff all the time, and all that is necessary is to go and take it."—EDITOR.]

BY THE WAY

How Disputes Over Mining Claims Were Settled in '71

THE litigation between Nevada Consolidated and Consolidated Coppermines over the mining of their adjoining claims at Ely is not without precedent. From *Engineering and Mining Journal*, of May 2, 1871, we cull the following choice item:

"The troublous times threatened on Treasure Hill (at White Pine, Nev.) appear to be drawing to a focus and will probably end in bloodshed. The Richmond Company, having completed their preparations, have made everything ready to take possession of the ground claimed by them. The Eberhardt Company have fortified a house on the ground, barricaded with bags of earth, and convenient loop-holes to fire through when occasion demands, with a force of armed men to guard their interests."

Where Much of Our Silver Goes

THOUGH China and India continue the world's largest markets for silver, each consuming about twice as much as the United States, nevertheless one company alone—the Eastman Kodak Company, of Rochester, N. Y. —is responsible for taking five troy tons of silver a week off the market. This order is bettered only by the United States mints, says *Oil Power*. Most of this is used in the manufacture of more than 200,000 miles of moving picture film a year. The base of the film is cotton, which is made into cellulose nitrate, or cellulose acetate, in the making of safety film. The silver emulsion for coating the film is made by dissolving 42-lb. bars of pure silver in nitric acid, forming silver nitrate, which is heated and added to a solution of potassium bromide, potassium iodide, and gelatine. A light-sensitive silver salt is precipitated, and held in suspension by the gelatine.

Low-Wave Licenses Are Granted for Prospecting

ACCORDING to press report, eighteen portable radio transmitting licenses were granted to the Humble Oil & Refining Company recently by the Federal Radio Commission, for communication with exploration parties in prospective oil lands. The stations will operate on frequencies between 1,600 and 1,704 kilocycles.

Construction permits were previously granted to the oil company and full licenses have been granted upon the completion of the stations, which have a low power rating and are designed to be carried in either automobiles or on pack horses.

According to the petitions for licenses, the sets have an approximate range of 200 miles, and will be carried by exploration parties in making geophysical surveys of oil lands. Communication will be maintained with a home station located at Houston, Tex.

Wave lengths assigned to the oil company, in the vicinity of 100 meters, are considered ideal for intermediate distance communication. At the time the original application was made for the assignments, leading scientists of the country were summoned by the commission to testify on the value of radio for prospecting. It was stated that prospecting parties usually venture into the wilderness, and far out of the reach of telephone or telegraph circuits, and that radio offered the only solution to the problem.

Consultation

Methods of Fume Precipitation

"What are the common methods of precipitating smelter fume in the United States and what are their relative advantages and disadvantages?"

The simplest method of precipitating fume is by settlement in a flue of sufficiently large cross-section to reduce the velocity sufficiently to allow the fine particles to drop out of the gas flow. Balloon flues — so called from their cross-sectional shape—are used for this purpose. Great length must be provided, however, and settlement of the finest particles is difficult. Most smelters, therefore, have installed either baghouses or the Cottrell electrical precipitation system, the copper smelters favoring the Cottrell on account of the acid nature of the gases, and the lead smelters generally favoring baghouses. At one lead smelter, the Cottrell is used on Dwight & Lloyd roaster gases and the baghouse system for furnace and refinery gases. Both are 99½ per cent effective. The manager of this plant, however, finds the Cottrell is more delicate, requiring at least 60 per cent relative humidity for effective work, and that it also requires more labor and more supervision. He states that he would use the electrical system in a new installation on D. & L. gases if the charge were such as to produce elemental sulphur, in which case, of course, the combustible nature of bags would make them dangerous. The Cottrell has no competitor where hot corrosive gases would make short work of bags. Also, note a new form of bag filtration described on page 232 of the Feb. 9 issue.

Buyers for Zinc Flotation Concentrate

"Can you supply me with the names of a few companies in England, Belgium, and Germany which might be interested in buying, at this time, zinc flotation concentrate?"

The following companies might be interested:

La Vieille Montagne, Chenee, Belgium; National Smelting Company, Ltd., Llansamlet, South Wales; Sulphide Corporation, Ltd., Seaton Carew, England; English Crown Spelter Company, Swansea, South Wales; Cie. des Métaux d'Overpelt-Lommel et de Corphalie, Belgium; Soc. Anon. Métallurgique de Prayon, Prayon-les-Trooz, Belgium; "Berzelius" Metallhütten Akt. Ges., Duisburg, Germany; Akt. Ges. Bergbau, Blei-u. Zinkfabrikation zu Stolberg und in Westfälen, Münsterbusch, Germany.

INDUSTRIAL PROGRESS

Steel Containing Copper Is Highly Resistant to Atmospheric Corrosion

THE relative merits of copper-bearing steel as contrasted with those of non-copper-bearing steel exposed to the atmosphere are now well defined, and numerous engineers and architects are recognizing the value of copper-bearing steel. Many, however, for one reason or other, are not sufficiently acquainted with the subject to have formed a definite opinion, and, by reason of their interest in pipe and tubular products in general, could profitably review the subject to determine wherein copper-bearing material may be of useful service in their work. The following discussion is reprinted from an article entitled "Copper-bearing Steel Pipe," published in the National Tube Company's *National Bulletin,* No. 11.

First, this is not a new or an untried theory. The subject had had many years of study and experiment behind it. Numerous observations, laboratory and field tests, and actual service records for more than fifteen years have demonstrated that steel pipe containing a small percentage of copper has longer life under certain corrosive conditions than steel without copper; in fact, copper-bearing steel is being used in constantly increasing quantities and is being recognized more and more as a standard product for many purposes. However, copper-bearing steel, like many other useful products, has its limitations and is sometimes misused.

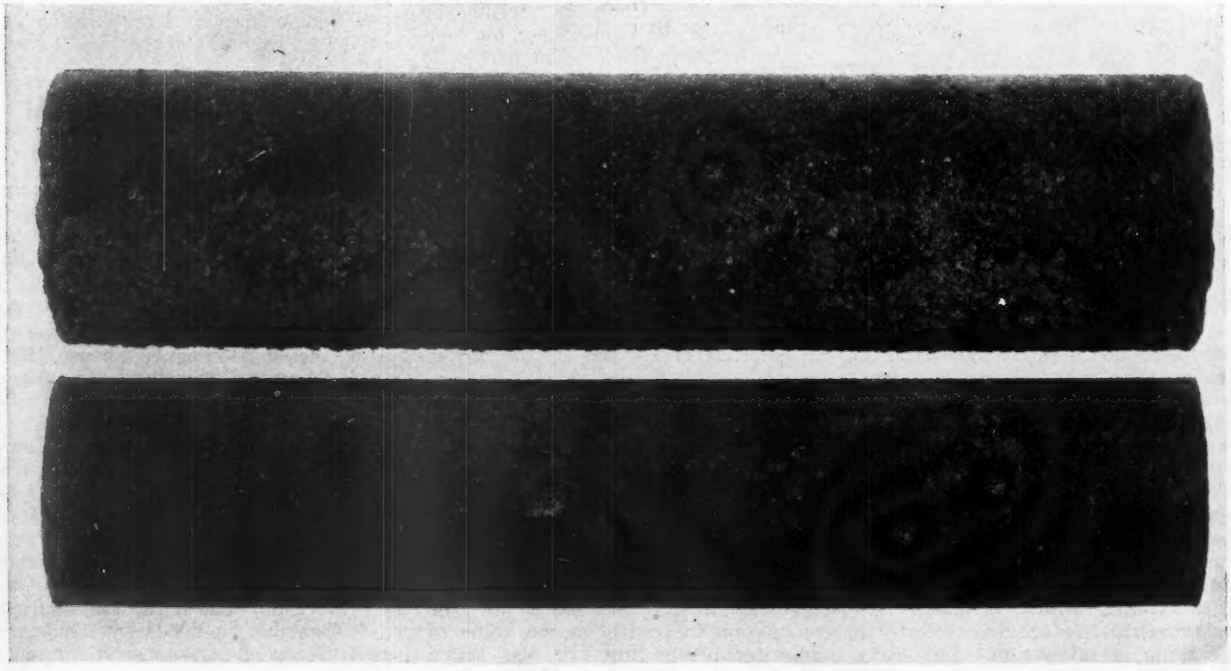
This should not be taken to mean that the small amount of copper added has any injurious effect, but that under some corrosive conditions the effect of this added copper is not apparent and the extra investment, even though slight, would be wasted and disappointment would result to the user. It is important, therefore, to understand, at least in principle, the nature of different types of corrosion and the proper application of copper-bearing steel necessary to secure the desired result.

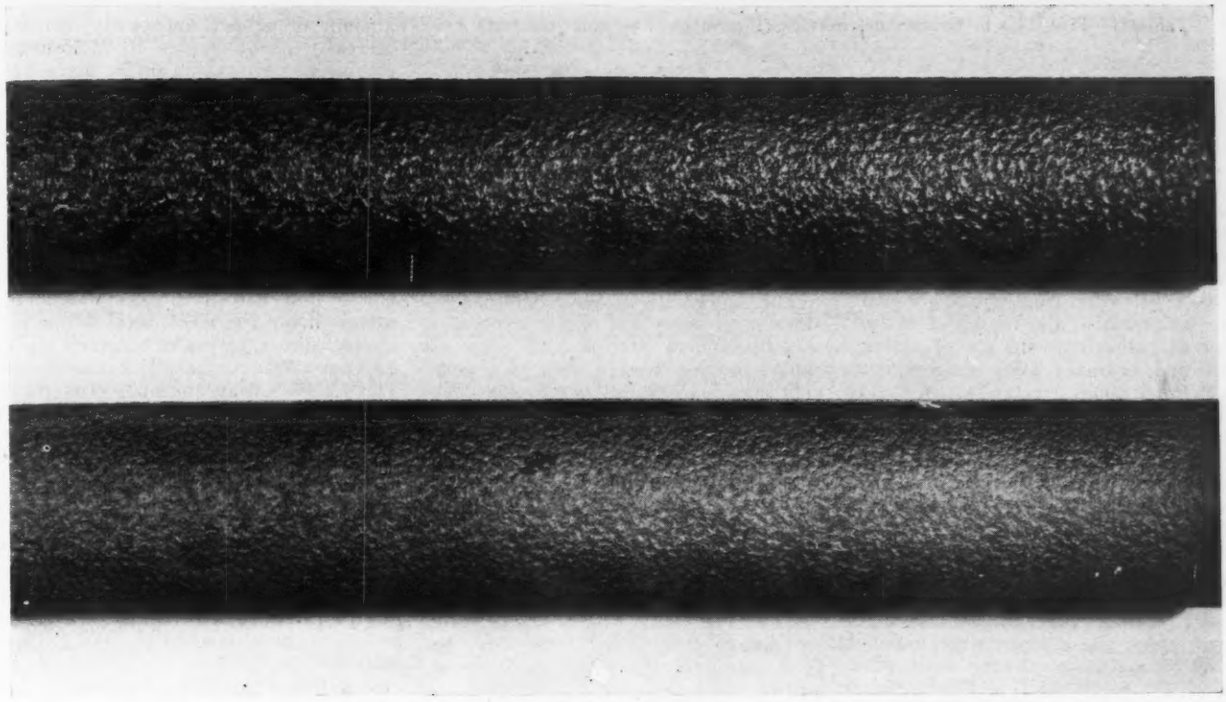
The many different types of corrosion, influenced by some thirty or forty different factors external to the metal, may be grouped under five main types as follows: (1) Atmospheric corrosion; (2) corrosion under water; (3) soil corrosion; (4) chemical corrosion; and (5) corrosion caused by imposed electric currents (electrolysis.)

Although the best results from the use of copper-bearing steel have been obtained from its application to atmospheric corrosion, experiments are still in progress in an effort to adapt it to the other items of the classification.

The most comprehensive and valuable tests on record, showing the relative durability of various metals, with and without copper, when exposed to atmospheric corrosion, are those carried out by the American Society for Testing Materials. Although these tests were made with the several metals in sheet form, they are indicative of results which would have been obtained had the metal been in the form of pipe or any other shape. A large number of black uncoated sheets 36x96 in. of both 16- and 22-gage materials were exposed on racks

Sections of non-copper-bearing (upper) and copper-bearing (lower) steel pipe that have been subjected to a moist mill atmosphere for seven years





Sections of non-copper-bearing (upper) and copper-bearing (lower) steel pipe on which an atmospheric corrosion test has been conducted over a period of twelve years

at Pittsburgh, Pa.; Fort Sheridan, Ill.; and Annapolis, Md. They were so exposed out of doors as to receive the same intensity of sun and other atmospheric variations not purely climatic in nature. Pittsburgh is typical of industrial atmospheres which contain various corrosive gases; Fort Sheridan is a typical rural district with pure air, and Annapolis has a sea-front atmosphere. Thus, typical atmospheres have been under test.

Though the tests were started in 1915, they are not yet completed (1929), as some of the sheets have not yet failed. The tests in Pittsburgh were discontinued after 75 months, as the government had other use for the grounds upon which the racks stood and the latter could not be moved safely. At this time all the non-copper-bearing 22-gage sheets had failed and nearly all of the non-copper 16-gage. None of the copper-bearing 16-gage sheets had failed and many of the 22-gage were still quite serviceable.

The rate of failure at Pittsburgh was several times faster than at the other locations, but the order of failure of the different materials has been the same in all three locations. This is most significant. The *Proceedings* of the American Society for Testing Materials every year since 1915 have given progress reports on tests in other localities, but nothing has developed to change the findings of the Pittsburgh tests shown in Table I.

Surveying the results with 22-gage material shows that Bessemer copper-bearing steel has a life approximately three times as great as the best of the non-copper-bearing metals. When one realizes that only 5 of the 23 Bessemer copper-bearing steel sheets (22-gage) had failed at 75 months when the test was discontinued, and that 18 sheets were still intact, one will perceive that the figure for this metal is probably much lower than it would have been had the test been continued. Many hold the opinion that the average life of the 22-gage Bessemer copper-bearing sheets would have been well over one hundred months had the test been continued until all sheets failed. Of significance, also, is the fact that only two of the 80 non-copper-bearing sheets of 16 gage had failed after 75 months, and not one of the sheets containing copper had failed.

At Fort Sheridan, Ill., so far the results show that of the 136 22-gage copper-bearing sheets only 38 per cent had failed after 132 months' exposure. On the other hand, of the 83 non-copper-bearing sheets of the same gage, 93 per cent had failed after exposure of that duration.

An interesting experience with copper-bearing steel over a period of fourteen years on gondola and hopper cars of the Bessemer and Lake Erie Railroad is described by John S. Unger (*Railway Age*, Vol. 84, No. 18, May 5, 1928). These cars were built one-half of copper-bearing steel plates and one-half of plain open-hearth steel plates, the copper steel and plain steel plates each being put in the same car. Mr. Unger summarizes the experience as follows:

"1. Paint adheres very much better to copper-bearing steel in a car body than it does to plain open-hearth steel.

"2. The saving in repainting cars, due to better adherence of paint to copper-bearing steel, would be sufficient to justify the use of copper-bearing steel in the bodies of steel freight cars.

"3. Where mechanical abrasion has not been a serious factor, as in the side sheets of gondolas, the loss in thickness for the copper-bearing steel was only one-third as great as for the plain open-hearth steel.

"4. Where the steel was subjected to severe mechanical abrasion as well as corrosion, the loss in thickness for the copper-bearing steel was approximately 60 per cent as great as for the plain open-hearth steel.

"5. From the result of this investigation, it can be conservatively stated that the use of all copper-bearing steel in the body of the cars would increase the life of the car body from 33⅓ to 50 per cent."

Table I—Relative Atmospheric Corrosion Test on Black Uncoated Sheets in the Pittsburgh District—American Society for Testing Materials

		Non-Copper-Bearing		—Copper-Bearing—	
Gage	Material	Number Sheets	Average Life in Months	Number Sheets	Average Life in Months
22	Open hearth steel.....	15	17.2	74	54.5 (5)
	Bessemer steel.....	20	16.9	23	73.7 (18)
	Open hearth pure iron	37	22.8	37	43.8
16	Open hearth steel.....	14	54.4 (1)	56	75.0 (56)
	Bessemer steel.....	20	30.5	25	75.0 (25)
	Open hearth pure iron	46	52.0 (1)	39	75.0 (39)

Figures in parenthesis represent the number of sheets that had not failed when the test was discontinued (after 75 months).

Table II—Pipe Test in Greenhouse Service (Pittsburgh, Pa., nine-year test)

Mark	Copper Content	Length Feet	Loss in Weight Per Foot	Average Penetration Inches Per Year
A	Nil	4.5	.778	.004787
B	.056	4.0	.225	.001384
C	.129	3.5	.171	.001052
D	.216	3.0	.192	.001181

One of the largest railroads has conducted a series of tests to determine the relative durability of tie plates of various composition, including steel with 0.25 per cent copper. The period covered in the tests varied from two to six years. The underside of the tie plates showed more corrosion than the top or exposed side, and ordinary steel showed from eight to ten times greater loss in weight than did the same steel containing copper. As a result of this and similar experience, the use of copper-bearing steel for tie plates, track spikes, and material similarly exposed has increased considerably of late years.

A more extensive test has just been completed on pipes in which non-copper steel and copper-bearing steels containing various percentages of copper were used. These pipes were exposed to the atmosphere on the roof of a greenhouse in Pittsburgh, Pa., for nine years and two months. The samples were supported on wooden racks in such a manner that water could not drip from one pipe to another. All samples were 1-in. black pipe.

After nine years and two months' exposure, the samples were cleaned in ammonium citrate and weighed. The details of loss in weight and penetration are given in Table II. The figures show that the copper-bearing steel lost only about one-third as much weight as the non-copper-bearing material.

To obtain additional data regarding the relative durability of non-copper-bearing steel pipe and copper-bearing steel pipe in the atmosphere, a special test was decided upon, which was to include a sufficient number of each kind of pipe samples on suitably arranged test racks to give full opportunity to arrive at average results. Therefore, in 1915, twelve samples each of non-copper-bearing and copper-bearing steel pipe were exposed to the weather at a location near Pittsburgh. The Pittsburgh district was selected because of the sulphur dioxide and other corrosive gases found in the atmosphere at this place. The samples were cleaned of all grease and dirt and carefully weighed before being exposed. At irregular intervals they were removed from the racks, cleaned each time to remove loose rust flakes, and reweighed to determine the loss in weight. The non-copper-bearing material lost practically three times as much in weight as the copper-bearing material.

These tests are in line with many others that have been carried out by students of corrosion and by companies using ferrous materials which are exposed to the atmosphere. Citation of these would be merely repetition of the facts shown by the foregoing tests.

That these results apply only to atmospheric corrosion should always be kept in mind. In fact, the differences disclosed under these conditions have been found often to disappear entirely under other conditions. All these metals, moreover, have approximately the same life in water and soil.

The question is sometimes asked: since most pipes and sheets exposed to the atmosphere are painted, why use copper-bearing steel? This is a pertinent question. Paints are by no means everlasting, and frequently, owing to the development of pin holes and subsequent flaking, allow the base metal to be exposed to moisture in the atmosphere; therefore, if repainting is not frequently resorted to, rusting begins, and non-copper metal might have a relatively short life. However, if the base metal is copper-bearing steel, the pipe or sheet will serve its purpose satisfactorily for many more years. Morever, the paint seems to adhere better to copper-bearing steel, probably because of the lesser tendency for corrosion of the copper-bearing steel base under a paint film which might be more or less porous.

When buried in the ground, no material difference between copper-bearing and non-copper-bearing materials is noticeable. This is borne out by the Bureau of Standards soil corrosion tests in which 14,000 samples of pipe of different metals have been buried at 48 different place in the country. Every two years several samples of each material are removed from each location, and the corrosion is measured. This test is one of the most extensive and carefully conducted of any on record. So far, after six years, the records indicate that no one of the ferrous metals is superior to others under all soils in this test, and that variations in the soils are much more influential than the widest variation in composition between any of the metals under test. (See Bureau of Standards Bulletin No. 368.)

In fresh water, tests by the American Society for Testing Materials and others show no advantage or disadvantage for copper-bearing materials when compared with other materials. In sea water, the copper-bearing material appears to be somewhat superior. In acid solutions, the same or a somewhat greater superiority exists; and in certain districts, oil-well equipment of copper-bearing material has proved of considerable advantage.

In the early stages of experimentation copper was considered to be injurious, as the belief prevailed that it made the material "red short" and unweldable. Now, however, after years of experiment and close check upon its effect, the effect of small quantities of copper is not considered harmful in this respect.

Numerous tests have shown that the most desirable range of copper for welded material to be used in the atmosphere is from 0.20 to 0.35 per cent. Beyond this range, increasing the amount of copper apparently does not increase the resistance to atmospheric corrosion. However, under some special conditions, such as those found in certain oil wells, a higher percentage of from 0.75 to 0.95 per cent copper has been found beneficial. Owing to the fact that material containing these higher percentages of copper is somewhat difficult to weld, all pipe containing high copper is manufactured by the seamless process.

The influence of a small amount of copper upon the mechanical properties of steel is not very pronounced. Up to 0.35 per cent no material change occurs. The yield point and ultimate strength of both low and medium carbon material is slightly increased and the elongation and reduction of area slightly decreased. Therefore, generally speaking, the physical properties of copper-bearing steel of 0.20 to 0.35 per cent copper may be considered the same as non-copper-bearing steel of the same grade.

Copper-bearing-steel pipe is desirable for all places where piping is exposed to atmospheric conditions. It is particularly beneficial for use as vent pipes on buildings; for exposed handrails; for all exposed piping on locomotives and cars, and for railway signal work, including the signal poles, tickler and semaphore poles, pipe on bridges, sprinkler lines, flag poles, electric light and power poles, steel towers, and other equipment. Inasmuch as the fatigue of metals under stress is increased by corrosion, copper-bearing steel should be particularly valuable for this class of service.

The problem of preventing the annual loss to railroads and in building caused by corrosion has received considerable attention in recent years. The most practical remedy so far discovered for overcoming some of this trouble under certain conditions is the alloying of small amounts of pure copper with either normal open-hearth or bessemer steel.

Likewise, a considerable saving can be made in the oil and gas industry with copper-bearing steel pipe. As a result of tests made in certain oil districts, a large tonnage of this material, particularly of oil-well tubing, is now being used, with indications of an increasing use as tests and experiments prove a definite value in such service.

INDUSTRIAL NOTES

Edward L. Ryerson, Jr., has been elected president of Joseph T. Ryerson & Son, Inc., succeeding Joseph T. Ryerson, who will remain a member of the board and continue as treasurer.

The Wagner Electric Corporation, of St. Louis, has moved its Buffalo service station and branch sales office to 1796 Main St., Buffalo. The Buffalo office handles the Wagner motors, transformers, fans, and Lockheed hydraulic brakes, not only as a branch sales office but also as a repair shop and service station.

Personal Notes

John M. Tippett, of Central City, Colo., was recently in New York City.

A. D. Coulter, president of Empire Gold and Discon Gold, companies operating in Oregon, is in New York City.

F. C. Baker, of Goldfields American Development, recently left New York City for Europe. He will be gone about five weeks.

Professor **R. J. Colony,** of the Columbia School of Mines, will teach geology this summer at the summer school of the University of Wyoming, at Laramie, Wyo.

E. M. Spieker, of the U. S. Geological Survey, recently left Columbus, Ohio, to begin field work in the Wasatch Plateau, Utah. He will be assisted by **A. J. Eardley,** of Princeton University.

W. M. Drury, general manager of the Mexican mines of American Smelting & Refining, has moved his office from El Paso to the company's headquarters at 120 Broadway, New York City.

John M. Fox, mining engineer, of Johannesburg, Calif., is general manager in charge of the operations of Engineers' Exploration, at the Ophir silver-lead mine, near Trona, Calif.

Abraham Thomas, who had been an employee of the Simmer & Jack mine, on the Witwatersrand, in South Africa, for the last 31 years, retired from service recently and returned to his home in Wales.

J. R. Thoenen, of the U. S. Bureau of Mines, is on an extended field trip through the South and Colorado, Utah, and Wyoming to investigate the commercial possibilities of development of alunite and leucite for potash.

Dr. **H. Foster Bain,** secretary of the A.I.M.E., has returned to the United States. He had been in Colombia, South America, since March as one of four members of an international committee to devise new oil legislation for the country.

Lieutenant-Colonel **J. P. Grenfell,** chairman of the Messina (Transvaal) Development Company, recently visited the company's copper properties in the Zoutpansberg district. The company intends opening up a new mine, the Campbell, during the year.

J. T. Pardee, of the U. S. Geological Survey, is leaving for Helena, Mont., where he will spend a few days studying new developments in mining, and will then go to Grants Pass, Ore., to begin a survey of mineral deposits in western Oregon in co-operation with the state.

Leslie Urquhart, chairman of the board of directors of Mining Trust, Ltd., accompanied by **D. P. Mitchell,** a director, and **Charles A. Mitke,** consulting engineer, sailed from England on June 6 for New York, where they will stop before proceeding to the Mount Isa mines, in Queensland, Australia.

C. H. Monroe and **Frank A. Short,** mining engineers, of San Francisco, have been engaged to investigate the status of placer mining claims in San Gabriel Canyon, where a flood-control dam is under construction. An ejection lawsuit has been brought by Los Angeles County against the claim owners.

H. N. Lawrie has been appointed clerk of the Senate Committee on Mines and Mining at Washington, D. C., and

H. N. LAWRIE

personal assistant to Senator Oddie, its chairman. Mr. Lawrie is a graduate of the Columbia School of Mines and carried on a general consulting practice as geologist at Portland, Ore., for several years.

George Helmrich, formerly mine superintendent at the Braden Copper properties, near Rancagua, Chile, has been appointed superintendent of the Frood mine of International Nickel, at Sudbury, Ontario, Canada. **F. J. Eager,** superintendent of the Levack mine of the same company, has been transferred to the Frood mine, where he will be assistant superintendent.

C. J. B. Armstrong, mining engineer, has been appointed resident engineer of Ridgedome Mines, Ltd., which is starting operations on its property in the Porcupine district of northern Ontario. Mr. Armstrong was formerly general superintendent of the Northern Customs Concentrator, at Cobalt, and for the last four years has been engaged by Hollinger Consolidated.

Dr. **Victor Dolmage,** director of the British Columbia office of the Canadian Geological Survey, has resigned and will join the firm of R. H. Stewart, Batten & Associates, mining engineers, as consulting geologist. Dr. Dolmage has been in charge of the Vancouver office of the Survey since Dr. **Charles Camsell** was promoted to Federal Deputy Minister of Mines, about seven years ago.

Frank H. Probert, Dean of the College of Mining, University of California; Prof. **C. K. Leith,** of the University of Wisconsin; and Dr. **George Otis Smith,** Director of the U. S. Geological Survey, are among the contributors of technical papers to be discussed at the forthcoming World Engineering Congress at Tokio, Japan, beginning Nov. 1 next. The American delegation will embark from San Francisco on Oct. 10.

H. T. Airey, field engineer for Britannia Mining & Smelting, is now at the Toric mine, in the Alice Arm district of British Columbia, which has been optioned by his company. He is planning exploration of the property by diamond drilling. **R. R. Brock** will be in charge of this work. Mr. Airey recently examined the properties of Topley-Richfield Consolidated, near Topley, B. C., and Owen Lake Mining, near Burns Lake.

Julian D. Conover, secretary of the Tri-State Zinc & Lead Ore Producers' Association, of Picher, Okla., has been appointed secretary of the American Zinc Institute to succeed **Stephen S. Tuthill,** whose resignation takes effect on Aug. 1. Mr. Conover went to the Tri-State district from Michigan six years ago, when the ore producers' association was first organized. Mr. Conover will be succeeded at Picher by **M. D. Harbaugh,** of Madison, Wis. Mr. Harbaugh has recently been connected with Mason, Slichter & Gauld, Inc., geophysical exploration engineers, as a geologist and mining engineer. Mr. Conover will leave Miami, Okla., for New York about July 1 to familiarize himself with his new duties.

OBITUARY

Gert de Beer, a son of J. N. de Beer, at one time owner of the Vooruitzicht farm, at Kimberley, now known as De Beers Consolidated Mines, died at Christiana, Transvaal, recently.

Richard Phelan, mine operator in Sierra County, Calif., and one of the pioneers in the development of the rotary furnace in quicksilver metallurgy, died recently at Oakland, Calif.

H. Rose Martin, general manager of the Strathmore mine, near Klerksorp, Transvaal, was accidentally killed on May 3. He was superintending unloading of machinery at the time. Mr. Martin had been engaged at various times in mining on the Rand, in Rhodesia, and in New Zealand.

Eben Erskine Olcott, president of the Hudson River Day Line, and former mining and metallurgical engineer, died in New York City on June 5, at the age of 76. He was a graduate of the College of the City of New York and of the Columbia School of Mines. He had been superintendent of the Orinoco Exploring & Mining Company, operating in the Caratal gold district of Venezuela, and of the Pennsylvania Lead Company, near Carnegie, Pa. He also worked for a time at the Ore Knob copper mine, in North Carolina. Subsequently he became associated with John Hays Hammond in an examination of the Bunker Hill & Sullivan mine, in the Coeur d'Alene district, Idaho. In 1895, owing to the sudden death of Charles T. Van Santvoord, Mr. Olcott became associated with his father-in-law, Alfred Van Santvoord, in the operation of the Hudson River Day Line, retiring from active work in mining engineering. However, in 1901 he was elected president of the A.I.M.E., of which he was still a member at the time of his death.

Book Reviews

How the World Wags

A PICTURE OF WORLD ECONOMIC CONDITIONS. *New York: National Industrial Conference Board. Pp. 253. Price, $2.50.*

RAPID spreading of the cartel movement throughout Europe, even into the smaller industrial countries of the Continent, is disclosed in the various reports on current economic developments in foreign countries made to the National Industrial Conference Board by its foreign correspondents, whose special reports constitute Part 2 of the board's second semi-annual volume on world economic conditions, just published. Cognizance is also taken of the American economic penetration of Europe, indicating a significant reversal of the flow of capital and industrial enterprise between the two continents, and governmental policies in the various countries relating to industry and trade and the international economic implications of such policies are discussed in detail. A summary picture of economic progress in each country is contained in the first part of the volume, giving authentic data on production, wages, employment, prices, foreign trade, and public and private finance.

The organization of syndicates and mergers, for production as well as for marketing purposes, figures prominently in the report on Great Britain. Paris reports that, with the franc stabilized and, for the time being at least, freed from the influence of political vicissitudes, trade has resumed its pre-war normal character, marked by a heavy excess of imports over exports, offset largely by the heavy foreign tourist expenditures in that country. From Germany, Franz von Mendelssohn, financier, reports that business has been greatly slowed up during the past year and that large business commitments are being held up pending a settlement of the reparations question, which is inextricably tied up with export and tariff problems; that further rationalization of industry is impeded by lack of capital and high interest rates; that the high cost of doing business, which is a burden to all branches of economic activity, weighs particularly heavy on agriculture and is leading to a more intensive and selective production which can be marketed at home at increased prices, in preference to the growing of grains which are subject to world price competition.

In Italy, the stabilization of the lira has impeded exports, according to Antonio Stefano Benni, president of the Confederazione Generale Fascista dell' Industria, Milan. Costs of production, he reports, are higher than those of competing countries.

The spreading of the cartel or merger movement to southern Europe is indicated by the fact that in Italy 150 industrial and commercial companies were merged during 1928. Georges Theunis, Minister of State of Belgium, by way of illustrating the degree of industrial consolidation in that country, points out that, although the total industrial joint-stock enterprises in Belgium, 4,760 in number, have a combined capital of about 17,500,000,000 francs, 159 of them represent 8,000,000,000, or nearly half of the combined capital of all such enterprises, and are controlled by banks.

In Russia, the present chief problem is that of keeping the peasantry in line while the industrial structure is being built up, as agriculture remains the chief source of income of the Soviet state and hence has to bear the burden of the cost of government, which in this case includes large capital expenditures for industrial rehabilitation and expansion.

R. M. DAVIS.

EARTH FLEXURES. *By H. G. Busk. Cambridge, England: University Press; American agents: The Macmillan Company, New York. Pp. 106; illus. Price $4.*

THIS handy book deals with the geometry of earth flexures (folds), and their representation and analysis in geological section, with special reference to the problem of oil finding. Though intended primarily for oil geologists and containing no special treatment of faults, it should prove of interest to those specializing in the economic geology of metalliferous deposits, such, for example, as replacement deposits in limestone, and most certainly to all serious students of the wider subject of structural geology. Chapter I is introductory, Chapter II deals with geological processes, and includes an interesting discussion of slip between adjacent beds during folding. Chapter III treats of the geometrical construction of earth flexures in geological sections.

The treatment is entirely geometrical and takes the form of fourteen propositions, which cover such subjects as thickness of strata, drawing the curve assumed by strata for which consecutive dip readings in the same direction are available, interpolated dip, overfolding, attenuation, and variation. Chapter IV is concerned with the subject of axial plane and problems connected with the location of that surface, as well as the axial plane and attenuation of the middle limb of a fold. Geological mapping for accurate section drawing forms the subject matter of Chapter V, and in Chapter VI, flexures of Tertiary age in the petroliferous rock of some extra-European countries are dealt with. In the latter, the author discusses some countries that have come under his own direct observation; these consisting of Burmah, Southwest Persia, and the West Coast of the Peninsula of Sinai. Among the features of these, the rift valley structure as illustrated by the eastern margin of the Gulf of Sinai is given attention.

The book contains 92 illustrations which take the form of diagrams and sections as well as block diagrams illustrating geological structure. The binding, printing, illustrations, and general "get-up" are good; and, generally speaking, the book can be recommended to the circle of readers for whom it was written as well as to the wider one indicated at the beginning of this review.

H. C. BOYDELL.

COMMODITY EXCHANGES. *By Julius B. Baer and George F. Woodruff. New York: Harper & Brothers. Pp. 319. Price $5.*

ONE of the authors of this book directed the legal work in connection with four of New York's recently organized exchanges and in establishing their place in the commercial world. The factors common to the various exchanges — rubber, silk, cotton, grain, metal—how they differ, and the advantages they offer to those dealing in specific commodities, are explained.

Follow details as to the workings of the futures contract, the difference between the cash and futures markets, the need for the futures contract in modern distribution, how it should be used by dealers, manufacturers, and others, its possible evils and how they have been obviated. The authors discuss the government, organization, and internal machinery of exchanges and their allied institutions—clearing associations—together with methods of trading on the exchange floor. Information is given on facilitating buying and selling, the stabilization of prices, the prevention of corners and "squeezes," basis contracts, use of warehouse receipts in trading, and other advantages that commodity exchanges offer.

The "hedge"—of importance to dealer, manufacturer, producer, and as a means of price insurance—can be used to remove business from the range of speculation to a sound merchandising basis. Practical problems are cited of placing and shifting the "hedge," supplemented by details of practices in different trades, the effect on price changes in cash and futures markets, with a summary of the conditions under which the "hedge" works most effectively. The rôle of the speculator in this connection is set forth.

A description of the work of the exchanges is followed by an explanation of how their auxiliary functions—including the maintenance of grading, weighing, and inspection systems, and the collections of statistics, reports, and information—can be used to best advantage. The book closes with a description of the legal phases of the subject.

NEWS OF THE WEEK

Summary

ROAN ANTELOPE drill holes indicate that the orebody dips more sharply in center of syncline than had been expected, thus adding to probable tonnage at this Rhodesian copper property. Construction work is progressing rapidly. Page 970.

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American Smelting & Refining is building a 300-ton concentrator at Chihuahua, Mexico, to treat carbonate silver-lead ore from its Santa Eulalia properties. Page 973.

* * *

Phelps Dodge has completed driving its 4,300-ft. drainage tunnel at the Humboldt mine of the Morenci branch in Arizona. Page 971.

* * *

Bristol Mining is deepening its shaft at Pioche, Nev., to 2,200 ft. and Combined Metals, in the same camp, is opening up an important orebody on the 950 level. Page 972.

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The Lindsley interests, of Toronto, have added to their holdings by acquisition of a nickel refinery in Norway, where matte from Falconbridge Nickel will be refined. Page 974.

* * *

Plans for operation of the Postmasburg manganese deposit in the Cape Province, Union of South Africa, have been made, and construction of the railroad and a treatment plant decided upon. Page 971.

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Noranda Mines has followed the "H" orebody on the 975 level of its mine in the Rouyn district of Quebec for a distance of 800 ft., of which 200 ft. was east of the diabase dike. Page 974.

* * *

Lucky Tiger-Combination Gold has failed to find the downward extension of its Gold Hill deposit below the No. 13 level, at its mine at Moctezuma, Sonora, Mexico, and unless new ore is found the company will soon have to decrease production from this mine. Page 973.

Oddie Asks for Increase on Manganese in Tariff Bill

By Paul Wooton
Special Washington Correspondent

INCREASES in duties on manganese are proposed in an amendment to the tariff bill introduced June 7 by Senator Oddie, of Nevada. He asked for a tariff of 1½c. per pound on ores with a manganese content of 25 per cent and above; 1c. per pound on 20 to 25 per cent ores, and ½c. per pound on 10 to 20 per cent ores. In explanation of his amendment, Senator Oddie issued the following statement:

"The present tariff of 1c. per pound on the manganese contained in ores of 30 per cent and above (ores containing less than 30 per cent being duty free) has proved inadequate. This is due largely to the new metallurgical practice in using ores of low manganese content, which has permitted the importation of low-grade ores that now enter the country duty free. The manganese producers in the United States cannot compete with the underpaid labor of Soviet Russia and other foreign countries. The tonnage of dutiable manganese ores since 1927 has been declining, thereby materially lessening the revenue derived from this source. Without a duty increase, this will continue.

"Since the last Tariff Act was passed in 1922 the Department of Agriculture has conducted experiments on a practical scale and demonstrated the value of manganese ores for fertilizer, so that in urging the adoption of this amendment at this time I believe it is strictly in line with the administration's program in confining the present Tariff bill primarily to the needs of the agricultural and livestock industries. It is not generally known that there are manganese deposits in 35 states, including those upon which the nation is depending most largely for agricultural output.

"If the domestic manganese industry can receive the benefit of the tariff provided in my resolution, the American farmers would be able to obtain this valuable fertilizer as a byproduct, which could be delivered to the farmers, particularly in the interior of the country, at much less than products from ores of foreign origin. The military and naval defense of the nation is also dependent upon the highly developed manganese industry of the United States. This country should no longer be compelled to rely upon the manganese ores of Russia or any other foreign country.

"The opposition of the steel industry is difficult to understand, for the reason that that industry is dependent very largely upon the domestic market and is now benefiting by the protection in the present Tariff Act. It would seem inconsistent, therefore, that the steel industry would deny to the manganese producers of the United States the small degree of protection which would be afforded by my amendment."

Engineers Exploration to Build Mill Near Trona

Engineers Exploration is installing a power-transmission line, a pipe line, and a mill-water supply pumping plant at its Ophir silver-lead property, 10 miles northeast of Trona, Calif. Mill construction will start this month. Concentration will be effected on tables, but the flow sheet is designed to permit the installation of flotation equipment for a portion of the circuit after tabling.

Will Build Tailing Plant in Kalgoorlie District

A cyanide plant will be built in the Kalgoorlie district, Western Australia, to treat tailing from the Golden Horseshoe dump. Estimates show that more than 2,000,000 tons of material, assaying about 7s. 10d. per ton, is contained in this dump. The new plant will have a capacity of more than 1,000 tons daily.

Virginia Manganese Mines Being Reopened

A New York company, headed by H. C. Smith, has leased the Old Dominion manganese mines, near Crimora, Va., from Charles Harman, of Charlottesville, Va. About twenty men are employed rehabilitating the property, and this force will be increased when production is resumed.

Install Diesel Engine at Morning Glory Mine

Installation of a 350-hp. Ingersoll-Rand Diesel engine at the property of Morning Glory Mining & Smelting, in the Patagonia district of Arizona, is now proceeding. The power will be used to operate a 100-ton selective flotation mill. An additional compressor will also be installed. This new equipment is now on the ground. The ore carries copper.

Drills at Roan Antelope Prove Ore Extends Deeper Than Had Been Estimated

Two New Holes Indicate Orebody Dips Sharply—Progress Report Shows Construction Work Well Under Way and Uniformly Good Results of Development Continuing—New Vertical Shaft Projected

ORE has been found in diamond drill holes Nos. 48 and 42 at the Roan Antelope Copper Mines property, in the N'Dola district of Northern Rhodesia, at a depth of about 1,700 ft., according to cable advices received in New York. These holes were drilled between the outcrops of the synclinal trough that forms the orebody, and they show that it dips more deeply than had been expected. The management estimated that these holes should encounter ore at about 1,300 ft. Thus this new development work indicates 400 ft. additional ore and likewise that mining will probably be carried on much more economically and easily than could have been possible had the orebody been shallower. In addition, drilling at No. 9 hole on the Roan Extension property shows ore at a distance of 27,000 ft. from the southeast end of the orebody.

In the accompanying sketch map, which was included in the progress report of the company for the three months ended March 31, but which shows drilling results up to May, the general shape of the orebody can be seen. At the southeastern end of the orebody, it is bottomed at 700 ft. No. 14 drill hole, which is exactly opposite No. 48 drill hole, struck ore at a depth of 496 ft., whereas No. 48 drill hole did not find ore until 1,679 ft. had been drilled. At that depth the true width of the orebody was estimated at 11.8 ft. of ore, averaging 4.04 per cent copper. No. 42 drill hole hit ore at a depth of 1,723 ft. and passed through it for a true width of 15.6 ft., averaging 3.16 per cent copper. Hole No. 22, which is opposite No. 42, found ore at a depth of 734 ft.

Roan will sink a new vertical shaft near the present site of No. 2 incline shaft. A boiler plant for sinking has been completed and the hoist to be used during sinking operations is on the ground. The compressed air supply at the mine has been improved somewhat with the completion of a third boiler at No. 9 shaft compressor plant, according to D. D. Irwin, general manager of the company, as detailed in the progress report. However, the amount of underground work that can be done will be limited until the first unit of the permanent power plant goes into operation.

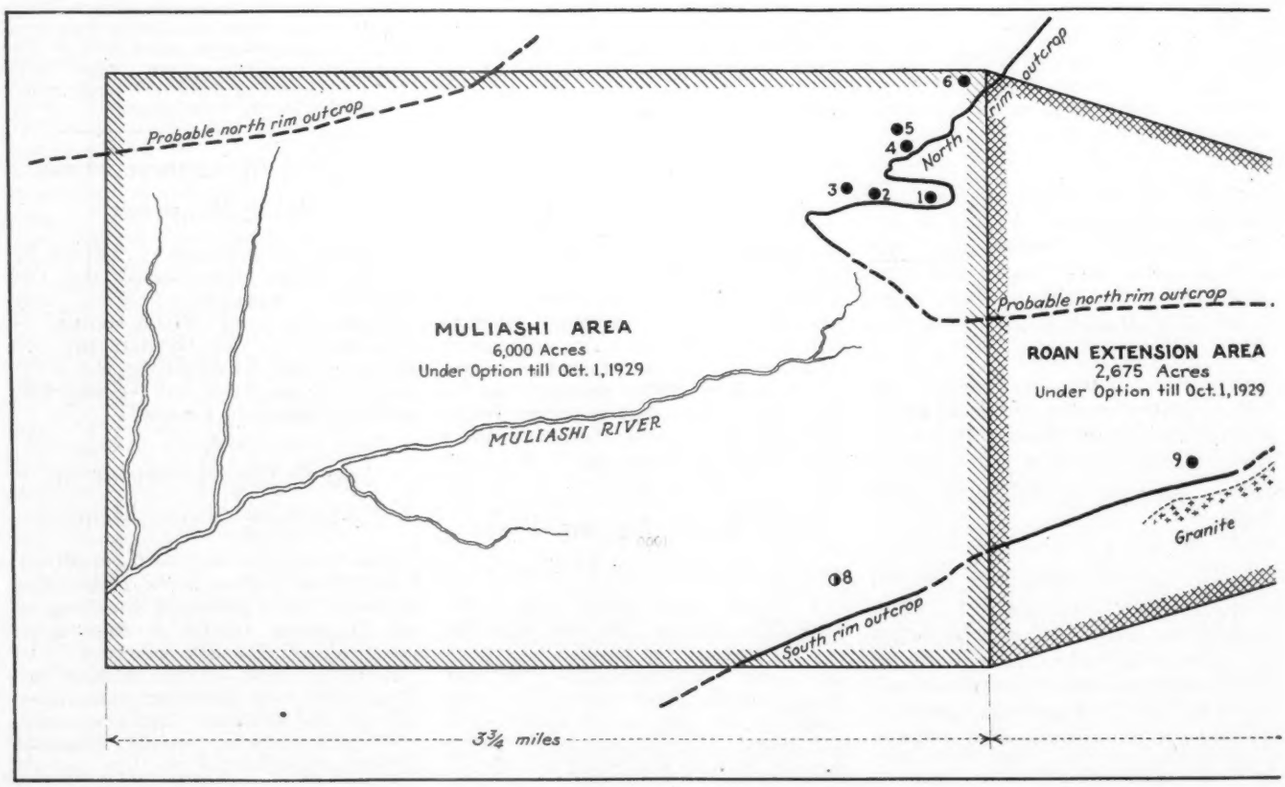
The building for this unit has been completed, together with the foundations for the 1,250-kw. turbine set and two electrically driven compressors. Steel work for the boilers has been completed, and one of the boilers has been received and is in the process of erection. Construction work was delayed considerably by the strike from Feb. 16 to March 8, which tied up the railroad, but the situation has since improved.

On March 31, 3,002 colored workers and 364 Europeans were employed at the property. The housing facilities are be-

Drilling Results at Roan Antelope

Hole No.	Depth Ore Encountered Ft.	True Width Ft.	Assay (Copper) Per Cent
1	458	36.5	3.87
2	341	27.5	3.40
3	526	36.5	4.00
4	671	26.8	2.81
5	514	38.0	4.15
6	616	30.0	3.80
7	596	31.5	2.60
8	440	28.5	2.64
9	1,033	47.1	3.65
10	621	16.5	3.18
11	847	14.5	3.17
12	700	24.5	3.24
13	605	17.3	3.13
14	496	11.6	3.69
17	551	11.0	2.70
19	667	9.5	3.46
22	734	16.1	3.28
25	647	21.1	3.75
28	648	14.8	3.36
34	736	13.1	3.22
40	531	10.2	3.79
42	1,723	15.6	3.16
48	1,679	11.8	4.04
R. E. 1	613.5	27.0	2.93
R. E. 2	512	24.2	3.04
R. E. 9	560	32.0	3.50
Muliashi 1	165	40	1.9
Muliashi 2	264	32.5	3.0
Muliashi 3.	No ore encountered, stopped at 800 ft.		
Muliashi 4	199 and 285	23* and 21*	2.19 and 1.94
Muliashi 5.	No ore encountered, stopped at 798 ft.		
Muliashi 6	265 and 462	17.5* and 28*	3.15 and 2.64

*True width not available.



ing taxed to the utmost to take care of the rapid increase in personnel. In the town site, the first unit of the dormitories for single men has been completed and the second two units are well along toward completion. Seventy houses are under construction, and the excavation and foundations for the hospital have been completed.

Complete Plans for Working Postmasburg Manganese Ore

COMPLETION of the various negotiations that have been in progress for a long time with a view to the establishment of manganese mining in the Union of South Africa is reported. A new company, the Manganese Corporation (1929), Ltd., has acquired the manganese, copper, and asbestos properties of the Union Manganese Mines & Minerals, Ltd., in the Postmasburg and Hay districts of the Cape province. Nominal capital of the company is £1,000,000 in £1 shares, of which £825,000 is paid up. All the working capital has been privately subscribed. Of the total of eight directors, five will be nominees of the British Swiss International Corporation, Ltd., and three will be nominees of Union Manganese Mines & Minerals.

Engineers have already left for the Postmasburg fields to take charge of operations on the company's properties. This district is about 100 miles west of Kimberley. For a long time the existence of extensive deposits of manganese ore has been known, but transportation and financial difficulties have hindered exploitation. Agreements have now been signed with the railroad administration for the construction of a railroad line to the manganese fields, and a plant will be erected at Colenso, in northern Natal, for the manufacture of ferromanganese, ferrochrome, and ferrovanadium. At Colenso the South African Electricity Supply Commission already has in operation a large power station, with a capacity of 60,000 kw., and this station is capable of considerable expansion. These ferro-alloy manufacturing operations will later be linked up with the proposed government iron and steel plant.

Ahumada Lead Now Mining on No. 8 Level

AHUMADA LEAD is now producing from the No. 8 level at its mine at Los Lamentos, Chihuahua, Mexico. In 1926, while cutting the station on this level, water broke into the shaft, thus preventing production from this level. Installation of a new Layne & Bower pump, with rated capacity of 1,400 g.p.m., in 1928, however, has brought the pumping capacity at the mine up to 2,400 g.p.m. and has permitted unwatering of the No. 8 level. Bulkheads are being put in the stopes to keep the water back. Inasmuch as the long delay caused by water had resulted in the practical exhaustion of the orebody above the No. 7 level, production at this property dropped during 1928. Operations at the No. 8 level have showed, however, that the ore continues at that depth as good as above.

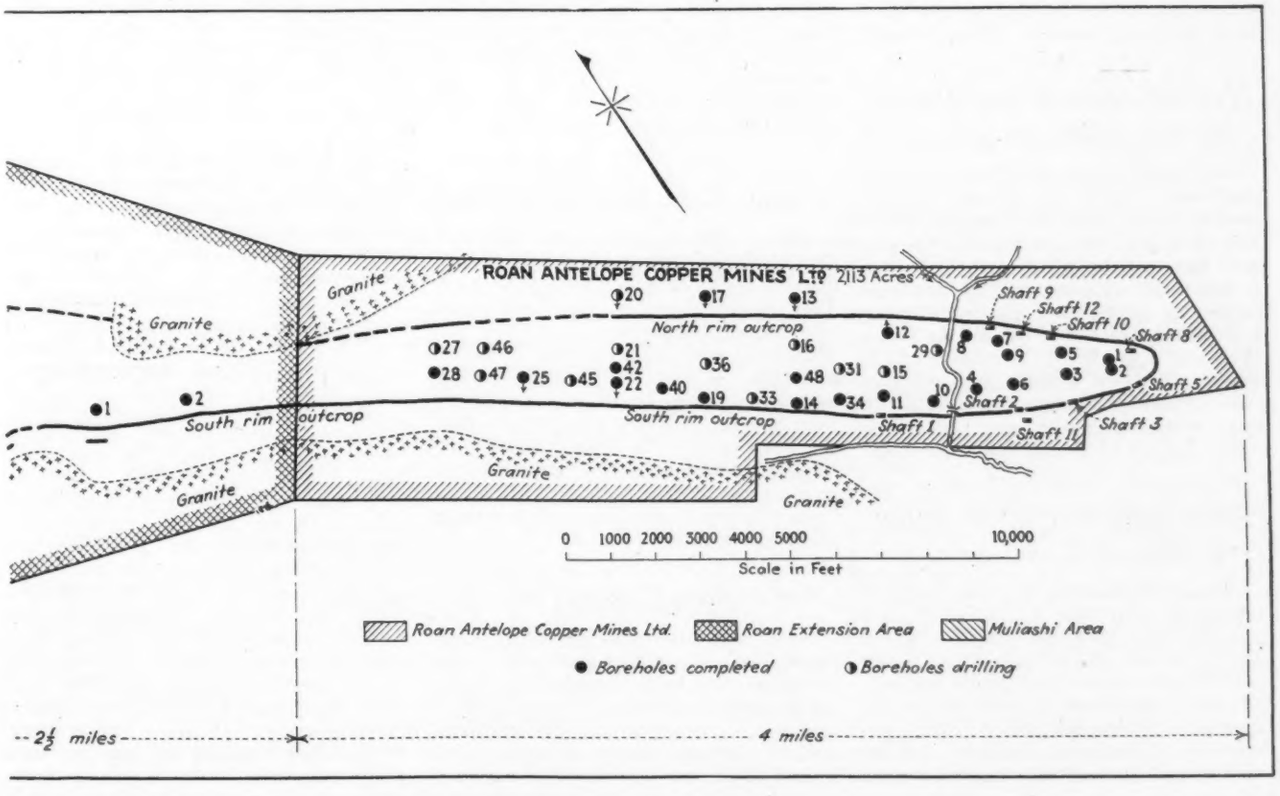
Morenci Completes Tunnel; Will Increase Diesel Plant

THE drainage tunnel for the Humboldt mine of the Morenci branch, Phelps Dodge Corporation, in the Morenci district of Arizona, has been completed, as well as the raise to the No. 14 level, the lowest operating level of the mine. Mine waters are now running out through the drainage tunnel, according to W. M. Saben, assistant manager of the Morenci branch. This tunnel is 4,300 ft. long. Deepening of the Joy shaft to the No. 14 level, which will eventually become the main haulage level, has been completed, and a new hoist of the elevator type will be installed next month. No. 6 shaft has also been deepened to the No. 14 level. This shaft will be used for hoisting ore exclusively and will eventually be connected with the drainage tunnel, which is 160 ft. below No. 14 level. A new hoist will be installed at No. 6 shaft before the end of the year.

Installation of the two 7-ft. Symons cone crushers at the concentrator has been completed, although the screens, bins, and feeders preceding these crushers are not yet installed. Three 8½x12-ft. ball mills are being installed in the primary grinding circuit of the concentrator, replacing three present mills of smaller capacity. These various changes will raise effective capacity at Morenci from 4,200 to 5,000 tons daily.

A new Nordberg F. H. Diesel engine will also be installed at the Morenci power house before the end of the year. The Diesel plant will then consist of six E. G. engines and one F. H. engine.

The Roan Antelope and its adjoining properties, now under option, showing plan of drilling



Two Pioche Mines Explore Holdings at Depth

BRISTOL SILVER and Combined Metals, operating in the Pioche district of Nevada, are both exploring their holdings at considerable depth. At the Bristol mine the shaft will be sunk to 2,200 ft. and at the Combined Metals property exploration is now centered on the 950 and 1,200 levels.

Production from Bristol Silver is averaging about 175 tons of silver-lead-zinc ore daily. The shaft, which will be sunk to 2,200 ft., is now approaching the 1,700 level. Drifting is being done on the 1,550 level to cut the downward extension of the orebody from which production is now being effected on the 1,200 level.

A new 360-hp. Diesel engine has been installed at the property, making a total of 840 hp. available from the new power plant. Another ore bin is under construction at the property. E. H. Snyder, manager of the company, states that earnings are ranging from $15,000 to $25,000 a month.

At the Combined Metals property, development work on the 950 level has been in ore for the last three months. North and south the ore has been followed for the last 400 ft. and for 250 ft. east along the strike of the Greenwood fissure. The average thickness of the deposit, which is a replacement in the Combined Metals bed, is 8 ft. This ore carries zinc and lead, with some silver and gold.

On the 1,200 level the company is drifting to explore the quartzite formation, from which the bonanza ore that made Pioche famous was taken. The Greenwood fissure which is now being prospected is an offshoot of the Raymond Ely and Meadow Valley fissures.

Ten Tri-State Mines Report No Accidents Since Jan. 1

Ten mines in the Tri-State zinc and lead fields, reporting to the accident prevention department of the Tri-State Zinc & Lead Ore Producers' Association, have worked since Jan. 1 without a lost-time accident. Seven of these properties belong to Commerce Mining & Royalty. The mines include the Grace Walker; Jay Bird, Scammon Hill, Wilbur, Webber, and Paxson mines of the Commerce company; the Crawfish mine of Eagle-Picher Lead; and mines No. 7 and 24 of Evans-Wallower Lead.

Geological Survey to Study Salmon River Area

During the summer of 1929 a party of engineers from the U. S. Geological Survey will survey and study the power and reservoir possibilities of the South and Middle forks of the Salmon River, Idaho. This work is part of a continuous investigation of the natural resources of Idaho carried on by the Geological Survey in connection with its classification of the public lands. The investigation involves the water-power, mineral, and agricultural value of every tract of public land, and indirectly it discloses the value of the neighboring privately owned lands.

North Lily Shaft Now Down to 1,600 Ft.

NORTH LILY'S shaft at Dividend, Utah, in the East Tintic district of Utah, is now below 1,600 ft. At this depth a siliceous limestone formation is being cut that is believed to be just above the Cambrian quartzite footwall. A good-sized lens of ore was opened up in sinking the shaft.

Two raises are being put up from the 1,200 level in a block of ground where the faulted segment of the orebody productive in the upper levels should lie. Raise 1,217 is cutting a mineralized limestone and raise 1,225 is following an ore-bearing fissure which cuts the limestone quartzite contact. A carload of sulphide ore has been shipped from this heading.

The company is also driving No. 721 along a fissure in the quartzite northeast on the 700 level, from which considerable ore has been taken. At favorable points, drifts and raises will be started into the overlying Ophir limestone.

Utah-Apex to Explore Fire Area on 1,250 Level

Bulkheads have been removed from the 1,250 level of the Utah-Apex mine at Bingham, Utah. If the fire that raged in that section of the property several years ago has burned out, the company will resume operations. The bulkheads were erected to smother the fire and prevent smoke and poisonous gases from penetrating to other parts of the mine.

Canam Buys McWhite Mine

Canam Metals, Ltd., has purchased the McWhite mine, in the Tri-State district, for an unreported consideration. This property adjoins the Foch mine, also recently acquired by Canam. The McWhite mine was recently reopened by Otis White, Ed. McKay, and associates, after being idle for more than a year. When Canam obtained the Foch property it began negotiations for the McWhite, as both properties can ship ore to the same mill. The McWhite lease consists of 80 acres and the Foch of 120 acres.

Gold King Changes Hands

Bond and lease on the Gold King mine, in the Cripple Creek district of Colorado, has been acquired by L. F. Le Brun, of Cripple Creek, from William Lenox, the present owner. The property is developed to a depth of about 1,000 ft. and has a total extent of 47 acres.

Consolidated M. & S. Applies for Power on B. C. Coast

THROUGH its power subsidiary, the West Kootenay Power & Light Company, Consolidated Mining & Smelting has made application to the British Columbia Water Board for the right to develop a hydro-electric station on the Lois River, south of the Powell River, B. C. Three days later the Powell River Pulp & Paper Company also made application for power rights on the same river, which is said to be capable of developing 20,000 to 25,000 hp. The Water Board will have to decide to which of the two concerns the power rights shall be granted. It is possible that a compromise may be made, and West Kootenay be given the rights on condition that it sells, at a rate fixed by the board, sufficient power to the pulp company for its needs. Consolidated is understood to want the power for the copper smelter and refinery that it intends to build in the near future at some point on the British Columbia coast. West Kootenay Power also has applied for rights on the Adams River, in the Kamloops district.

Metalsmith Drives Tunnel on Empire Mine, Near Helena

A NEW TUNNEL, to be known as No. 2 tunnel, is being driven by Metalsmith on the Empire property, near Helena, Mont., which it recently acquired. This tunnel has as its objective the downward extension of the Smithville and Empire veins, carrying gold ore, from which some production was made in the past on the No. 1 tunnel level, 200 ft. above. At a distance of 112 ft. from the portal, the new tunnel cut a vein. Drifting to the east disclosed that this vein was not the Empire vein, and the tunnel has been continued in a northerly direction. At 267 ft. from the portal another vein has been cut, but whether this is the Empire vein is not yet known. During May the tunnel was advanced a total of 300 ft., according to T. H. Kerruish, who is in charge of operations.

C. & H. Now Has Two Casting Wheels Operating

The new Clark casting wheel in the Calumet & Hecla smelter at Hubbell, Mich., is in operation. The unit is of local company construction. Two of these machines now are in use, giving ample capacity for all requirements. The modernization of the plant is now complete. Greater efficiency and economical operation have been effected by the improvements, consisting of two melting furnaces and two refining furnaces of large capacity, two casting wheels capable of turning out billets and other irregular shapes, and a modern mineral storage building. The refining furnaces are charged by gravity from the melting units.

The Achotla unit of Cia. Minera de Peñoles, American Metal subsidiary in Mexico

Peñoles Adding Baghouse to Its Torreon Smelter

Cia. Minera de Peñoles, American Metal subsidiary in Mexico, is adding a baghouse and a Dwight & Lloyd sintering plant to its Torreon lead smelter, at Torreon, Coahuila, Mexico. The plant has a capacity of 400,000 tons of charge annually and treats ores from the company's mines in northern Mexico. An important change is also being made in the method of treating silver-lead-gold ores at the company's Achotla unit, in Guerrero, which was described in an article by E. R. Richards in *Engineering and Mining Journal* of Sept. 1 and 8, 1928. The 300-ton plant is being changed from cyanidation to all-brine leaching method.

Lucky Tiger Fails to Find Orebody at Depth

EXPLORATION work at the property of Tigre Mining, Mexican subsidiary of Lucky Tiger-Combination Gold, in the Moctezuma district, Sonora, indicates the possibility that the bottom of the orebody has been reached, according to R. T. Mishler, manager of the company. No ore was found in the No. 7 level of the Fortuna mine, which corresponds to No. 21 level of the Tigre mine, although it was driven across the course of the Fortuna vein.

Small orebodies were developed on the main vein on the 13, 14, and 15 levels of the property, but the large Gold Hill deposit, which was practically continuous for 1,000 ft. in length and 1,000 ft. in depth and which furnished the bulk of the company's ore for the last twelve years, has apparently terminated at about the 13 level. Unless new orebodies are found soon, production will be decreased. In 1928, production amounted to 82,430 tons, from which 9,684 oz. of gold and 2,599,485 oz. of silver were recovered. The company has been in operation at the Tigre mine since 1903 and had paid dividends totaling $13,170,809 in that period, on a capitalization of $7,153,350.

At the Tigre mill, which has a capacity of about 250 tons daily, a Model D Dorr duplex classifier was substituted for two Model C simplex machines last year, and a marked reduction in tube mill costs has resulted. Construction of a Forrester flotation machine was recently completed, and extraction has been improved, although power costs are higher than with the older unit.

At its subsidiary property in Jalisco, operated by Tigre Leasing, some difficulty has been encountered in metallurgical operations. The company is considering installation of an additional Dorr classifier and additional tanks. The plant's present capacity is 80 metric tons daily, and as ore reserves total 174,414 metric tons of proved and probable ore, containing about 10 oz. of silver, a sufficient quantity of material is available for from six to seven years' operation at the present rate. In addition, W. A. Wasley, manager of Tigre Leasing, believes that excellent chances exist of developing considerable tonnage in the west end of the 400 and 500 levels.

Broken Hill South Is Reconstructing Its Mill

BROKEN HILL SOUTH, operating in the Broken Hill silver-lead district of New South Wales, is reconstructing its flotation mill. The original Broken Hill South concentrator was built in 1907, and as new processes were developed separate additions were built. Present work consists of putting all the units of the plant, which has a capacity of 1,000 tons daily, under one roof, and of replacing wood with concrete and steel. The mill is in four sections, of which one has been converted and the second is being demolished and rebuilt. When this work is finished, the slime plant, which is at present in a separate building, will be brought to the main building. The company is also sinking a new shaft, larger than any of the existing shafts.

A. S. & R. Building Mill for Carbonate Ores at Chihuahua

GROUND has just been broken for a new 300-ton mill that American Smelting & Refining will build at Chihuahua, State of Chihuahua, Mexico, to treat carbonate silver-lead ore from its properties at Santa Eulalia, Chihuahua. This company has had a similar plant, with a capacity of 800 tons daily, in operation at Santa Barbara for the last twelve years. Completion of the new mill is expected in about a year.

Coarse crushing at the new plant will be done in gyratory crushers and Symons cone crushers, and the fine grinding in rod and ball mills, each in closed circuit with the classifiers. Concentration will be by gravity and flotation methods.

American Smelting & Refining has had its new Monterey lead refinery in operation for the last two months. The company has not yet determined the capacity of the plant, as the revolution interfered with operations somewhat. Conditions have reverted to normal, however.

Prove Orebody for 2,437 Ft. at 340 Level of Fresnillo

DEVELOPMENT on the 340-meter level of the Fresnillo mine, operated by Mexican Corporation at Fresnillo, Zacatecas, Mexico, has proved ore for a length of 2,437 ft. in the Cuevo Santa vein. This compares with 1,837 ft., developed at a depth of 270 meters. The orebody averages 5 ft. in width at 340 meters, and carries 10.8 oz. of silver, 10.9 per cent lead, and 12.1 per cent zinc, which is higher in zinc, but lower in the other two metals than on the level above. The General shaft has been enlarged to full size and timbered to 340 meters. A raise is now being put up to connect with it from the 425-meter level. Milling operations are now at capacity of 2,500 tons of oxide ore and 400 tons of sulphide ore, although a small reduction was made in March because of the revolution. Ore production has been started from the San Nicolas section of the mine.

Bobby Anderson Strikes Ore

A crosscut driven 60 ft. below the tunnel level at the Bobby Anderson mine, in the Pine Creek section of the Coeur d'Alene district, has hit ore about 2 ft. wide. Another crosscut will be driven to the vein at a point 40 ft. below the strike.

New Pyramid to Build Mill

A 50-ton Vandercook cyanide mill will be constructed at the property of New Pyramid Mining, east of Sacramento, in Eldorado County, Calif. J. D. Chambers is president of the company.

Noranda's "H" Orebody Now Proved for 800 Ft.

DEVELOPMENTS at Noranda Mines, in the Rouyn district, Quebec, continue to enlarge the ore reserves and future ore possibilities. One of the most important of recent developments is the discovery that the "H" orebody continues east of the diabase dike. Practically all the ore found in this orebody to date has been west of the dike, but it has now been proved east for an additional 200 ft., making a length of 800 ft. in all. A drive running eastward for 220 ft. averages between 5 and 6 per cent copper and $1.50 in gold over the drift width, but the full width of the orebody is, of course, not known. The "C" orebody has also been found east of the dike and the 35-ft. length driven shows $6.50 in gold and approximately 1 per cent in copper over a width of 4 ft.

At the annual meeting held the latter part of March, shareholders were informed that diamond drilling had located a new orebody lying to the north of the "H" orebody and at greater depth. A diamond-drill hole has just been completed which shows a length of 115 ft. of ore, of which 75 ft. assayed 1.2 per cent copper and $7 in gold. This new hole finished in ore at a depth of 1,600 ft. below the surface, and, combined with the previous drilling, indicates a body of substantial size and very considerable importance. Ore of this grade would provide a satisfactory mill feed. At present the company is making experiments on the concentration of its ores with a view to the possible enlargement of the concentrator from 500 to 1,500 tons' capacity a day.

Copper Strike Reported in Portland Canal District

Two prospectors, Ernest Blue and Samuel Robinson, have discovered a deposit of copper ore at Rivers Point, on the Alaskan side of the Portland Canal, about 20 miles south of Hyder, B. C. It will take some time to determine the size of the vein, as it is said to be covered by 5 to 40 ft. of drift. The part that has been exposed is quartz, well mineralized with chalcopyrite and iron pyrite.

Maine Interests Buy Mine at Georgetown, Colo.

Purchase of the St. George mine, on Douglass Mountain, at Georgetown, Colo., by Maine interests has been announced. The new company will operate under the name of the Colorado-Maine Mining Company. George Leece, who has been in charge of operations at the property for several years, will remain as manager.

The property of the company consists of twelve claims, carrying gold-silver-lead-zinc ore and developed by four tunnels. A cable tramway, connecting the mine with a 75-ton flotation plant, was remodeled last year. The Colorado & Southern Railroad passes through the property.

Shaft Down 2,000 Ft. at Spanish Potash Mines

SINKING of the Alberto shaft, at the Cardona potash mines, in Spain, has reached a depth of about 2,000 ft., according to reports to the U. S. Department of Commerce. The Union Española de Explosivos is operating the property. The deposit is increasing in richness with depth, according to officials of the company. Rate of shaft-sinking is about 150 ft. monthly. Production from this property is expected to start before the end of the year. Construction work has been almost completed on most of the surface buildings.

End Litigation Over Claims in Bisbee District

MINERAL RIGHTS to 46 mining claims in the Bisbee district of Arizona were released from litigation recently when the register of the Phoenix land office canceled the claim of the heirs of Mary F. Stepp to the property. Several years ago Mrs. Stepp filed on the 640 acres of mineral land as a stock-raising homestead. The mineral rights to the land were not included in the homesteading proceedings. When the various holders of the mineral rights sought to develop their claims they were halted by a claim of homestead priority rights. Contest to nullify the homestead claim was started in June, 1926, at Bisbee by J. B. Tenney and others.

Carson Sued by Lawyer

George Campbell Carson and his associates are not through with litigations, as they are being sued in the U. S. District Court of San Francisco, by Antoine S. Pare, patent lawyer, for $100,000 for services rendered Carson during the time he was seeking to perfect his patents. Pare declares he became associated with Carson in 1908 and that he gave service in presenting the Carson patents and was his attorney for several years.

Employ 30 Men at Calaveras

Recent acquisition of control of Calaveras Copper at Copperopolis, Calif., by Engels Copper has been followed by plans for the operation of the mine. Thirty men are reported to be employed under S. M. Levy, former manager, and exploration for new orebodies is to be started.

Ventures Acquires Nickel Refinery in Norway

EXPANSION on the part of the Lindsley interests, of Toronto, still continues. The latest step is the acquisition, by Ventures, Ltd., of a refinery in southern Norway, where nickel matte from the Falconbridge smelter, in northern Ontario, can be treated. The refinery was known as Kristianssands Nickel, and Ventures acquires not only the physical property, but also all other assets, such as contracts for refining matte from Norwegian nickel mines and patents for the refining process.

At the Falconbridge mine, in Sudbury, rapid progress is being made in the preparation of the foundations for the new 200-ton smelter. As reported last week, the shaft at this property has been completed, and considerable lateral work, totaling about 1,000 ft. of crosscutting and drifting, will be done to determine the geology at this level before proceeding with the proposed campaign of deep diamond drilling. Some deep holes will be started about the middle of August to test the continuation at depth of the known ore and also to determine possible enrichment at depths between 2,000 and 3,000 ft.

As for the other Lindsley holdings in this district, two prospecting crews have begun work on the combined holdings of Sudbury Nickel & Copper, Sudbury Basin, and Ventures, all Lindsley-controlled companies. The properties to be investigated cover the northwest contact rim of the "basin" area for an almost unbroken length of 12 miles, including most of the territory lying between the Sultana mine and Windy Lake, between Windy Lake and the Levack mine of International Nickel, and along the north range between the Levack and Strathcona properties.

Two diamond drills are being used on the Sudbury Nickel & Copper properties, which alone include more than 10,000 acres. On at least three groups, officials state, ore has been struck, although sufficient work has not yet been done to determine the extent or the boundaries of the indicated orebodies. The properties on which ore has been found are the Strathcona mine, in Levack Township; the Murray property, formerly owned by Sudbury Ores, Ltd., and adjoining the Murray mine of International Nickel; and the McConnell-Tough group of claims, in Bowell Township.

Lack of Transportation Delays Howell Shipments

Howell Mining is drifting southwest along the Cardiff overthrust contact in Big Cottonwood Canyon, near Salt Lake City, Utah, to cut several fissures opened up in the old workings. The high-grade streak opened up for 140 ft. has not been mined, because of lack of storage and transportation facilities. As soon as the roads are open the company will start raising and drifting on this ore to the overthrust contact.

Societies, Addresses, Reports

Bradley Addresses Utah Section at Annual Dinner

THE Utah section of the A.I.M.E. entertained F. W. Bradley, president of the national organization, at the Alta Club on the occasion of its recent regular annual dinner. Mr. Bradley addressed members on work of the Institute and future plans. George H. Dern, Governor of Utah, made the address of welcome to the guest of honor, and Lafayette Hanchett spoke on the subject, "Lest We Forget." Frank M. Smith, smelter manager of Bunker Hill & Sullivan, accompanied Mr. and Mrs. Bradley to Salt Lake. J. M. Boutwell presided.

J. A. Norden, general manager of Utah-Apex Mining, was elected chairman for the ensuing year by unanimous vote, and Robert Wallace, superintendent of the Midvale plant of U. S. Smelting Refining & Mining, vice-chairman. C. T. Van Winkle was re-elected secretary.

A. S. & R. Contributes $25,000 to Salt Lake Hospital

THE sum of $25,000 has been contributed to the building of a new St. Marks Hospital at Salt Lake City, Utah, by the directors of American Smelting & Refining. Announcement of the contribution was made by William J. O'Connor, manager of the company at Salt Lake, who said that the donation had been voted at a recent meeting of the board. This amount will be added to the fund now being raised for the construction of a new hospital at the corner of Fourth East and First South Sts., Salt Lake City.

The contribution was made by American Smelting & Refining because it believes a necessity exists to replace the old St. Marks, one of the pioneer institutions of the Intermountain West.

Lake Superior Mining Men to Discuss Safety June 27

THE Lake Superior mining section of the National Safety Council will hold its eleventh annual mine safety conference at the Hotel Duluth, Duluth, Minn., on June 27 and 28. About 300 mining and safety men of the Lake Superior iron and copper districts are expected to attend, according to E. W. R. Butcher, of the committee in charge of the meeting. A. Y. Peterson, assistant to the president, Oliver Iron Mining, will deliver the address of welcome.

Nine papers will be presented at the meeting, and special features will include the annual banquet, at the Hotel Duluth, on June 27; a boat trip, including inspection of Duluth harbor, ore docks and other points of interest, on the afternoon of June 28; and a discussion of unusual mining accidents, in which ten engineers will take part. There will also be a safety exhibit, showing safety devices, models, drawings and photographs of safe practices.

Miami Announces New Plan for Employee Insurance

MIAMI COPPER has made arrangements with the Equitable Life Assurance Society to provide a plan of group insurance for its employees, at its mine at Miami, Ariz., which has several advantages over the present death-benefit plan, which the insurance is to supersede. Under the plan all employees who have been in the service of the company for one year may take $1,000 of life insurance, and for each additional year of service $100 may be added to a maximum of $1,500. Credit for past service will be allowed.

The company proposes to contribute two-thirds of the premium, and the employee will be called upon for the other one-third. The insurance will cost the employee at the rate of $4.80 per $1,000 dollars per annum, which compares with $24.38 per $1,000 per annum for straight life insurance at the age of 30 years. The policy also provides that if the insured employee becomes totally and permanently disabled before the age of 60, the sum of the insurance will be payable to him in monthly installments of not less than $50. Should the employee leave the company, the insurance may be converted to any of the Equitable's permanent contracts without medical examination at the regular rate for the policy selected at his then attained age. The insurance may be taken out by any employee who is eligible through length of service, without physical examination, provided he takes it out within 60 days of the time he becomes eligible. For the plan to go into effect 75 per cent of those eligible must accept it.

Geological Map of Arkansas Available in a Few Weeks

George C. Branner, state geologist, has announced that a new geological map of Arkansas has been completed after two years' preparation. This map will be on a 1:5,000 scale and will form a unit with the state maps of Oklahoma, Missouri, and Tennessee already published. The Arkansas map is being engraved and printed by the U. S. Geological Survey and will be available in a few weeks through the state geological survey. A new state topographic map also is being prepared on a contour interval of 250 ft. This will show power and gas lines, mines, quarries, oil fields, and other developed features.

Test Beryllium as Metal for Airplane Construction

THE materials subcommittee of the National Advisory Committee for Aëronautics is planning to arrange for tests of beryllium as a promising metal for aircraft structure. At present, beryllium occupies much the same position as aluminum did 40 years ago. It is an expensive and rather rare element in its refined state. Surveys show, however, that the potential world supply is at least as great as that of zinc. One large source of supply has been discovered in South Africa, and deposits are known to exist in parts of the United States. In this country beryllium has not been prospected for itself, but merely secondarily as it occurs with other metals.

A study of the small quantities available indicates that, although beryllium is lighter than aluminum, it possesses about the same strength. Its modulus of elasticity, however, is about the same as steel, or three times that of aluminum. Thus a beryllium column should be three times as stiff as an identical column of aluminum, as well as being lighter. Beryllium also is said to resist corrosion and to be practically unaffected by weather. These characteristics, it is pointed out, are extremely well adapted to aircraft construction. Though making no predictions as to the future of beryllium, the committee decided, in its meeting of June 7, to start extensive studies as soon as samples can be obtained.

James H. McGraw Awards Distributed at Atlantic City

The following are the winners of the James H. McGraw awards for 1929 in the industries identified with the National Electric Light Association, recently in convention at Atlantic City:

E. B. Strowger, Niagara Falls Power Company, Niagara Falls, N. Y., whose subject was "Operating a Hydro-Electric System for Best Economy."

H. George D. Nutting, Detroit Edison Company, Detroit, Mich., for a paper on "The Electric Water Heater."

Francis Heisler, Public Service Company of Northern Illinois, Chicago, who discussed "Peak Load in Steam Plants and Its Economic Generation."

Create New California Board

A bill has recently been passed by the California Legislature authorizing the Governor of the state to appoint a state mining board. This bill also changes the name of the existing division in the Department of Natural Resources from the Division of Mines and Mining to the Division of Mines.

MARKET AND FINANCIAL NEWS

Ventures, Ltd., Submits Its Proposition in Coniaurum Re-Financing

TERMS of the proposal for the reorganization and re-financing of the Coniaurum Mines, of Porcupine, are now announced through the deposit agreement sent to the Coniaurum bondholders. This company is capitalized at 1,200,000 shares of $5 par, of which 1,080,000 shares have been issued, and in addition has outstanding $800,000 worth of bonds. A few months ago the company went into the hands of a receiver, and unless a plan could be worked out to reorganize and re-finance, it would be necessary to dispose of the property by public auction. Negotiations were entered into with Ventures, Ltd., which has made a proposal, subject to the conditions that holders of 90 per cent of the bonds execute deposit agreements.

The proposal is that a new company be formed, having 6,000,000 shares of no par value. Of this amount 2,000,000 shares are to be given for the mining property and to be divided as follows: Coniaurum shareholders to receive one share of stock in the new company for each two shares held. This will require 540,000 shares of new stock. Coniaurum bondholders will receive 120 of the new shares for each $80 worth of bonds, which will require 1,200,000 shares. The balance of 260,000 shares is to be purchased at 40c. a share to yield $104,000, to provide for the indebtedness of the company. Of the 4,000,000 shares in the treasury, Ventures, Ltd., will contract to purchase 625,000 shares at 40c., for the carrying on of immediate development work. Ventures, Ltd., also takes options on further shares at prices ranging from 40c. up, and providing developments justify the exercising of the options, a total of $2,500,000 will be involved.

Coniagas Mines, Ltd., which holds the majority of both stock and bonds, is understood to be in favor of the re-financing arrangement, as are also the majority of the other important shareholders. There is every reason to believe that sufficient bonds will be deposited to permit of the plans being carried through.

When final arrangements have been completed it is proposed to sink a winze from the 2,000 to the 3,000 level, for the purpose of exploring the lower horizons. Developments down to the 1,500 level were considered favorable, but the 1,750 and the 2,000 levels yielded disappointing results. Coniaurum is equipped with a 300-ton mill, and it is probable that the mill will continue to operate.

To date a total sum of $2,000,000 has been spent on development and equipment of this property, most of the money having been advanced by the Coniagas Mines, of Cobalt.

WEST DOME LAKE GOLD MINES is to be reorganized and a new company is to be formed to take over the assets of the old. This action is the outcome of a decision made at a recent special general meeting of shareholders. The property, which lies directly west of and adjoining the Dome mine in the east Porcupine district, was formerly the Consolidated West Dome Lake Mines, Ltd., a consolidation of West Dome and Dome Lake properties. Operations have been carried on for a great many years and the property has produced an aggregate of close to $1,000,000 in gold. Owing to the narrow width of the veins, however, income has never been sufficient to cover development and operating expenses. Excess of disbursements over revenue during the last year amounted to $163,114. Reorganization proposals will provide for a new company, with 3,500,000 shares of capital stock of no par value each. Assets of the old company are sold to the new concern for 1,500,000 shares, the exchange equivalent to one share of new stock for each four shares of the old stock. This will leave 2,000,000 shares in the treasury of the new company, and it is intimated by Sir Henry Pellatt, president of the company, that if made attractive there is reason to believe that new capital can be interested to an extent that will thoroughly test the property.

COMPANIA MINERA DE TOCOPILLA, operating near Tocopilla, Province of Antofagasta, Chile, made a net profit of 6,282,141 Chilean pesos during 1928. Production was 24,751 tons of smelting ore, averaging 16.404 per cent copper, and 58,772 tons of concentrating ore, averaging 4.1 per cent copper. Ore reserves on Jan. 31, 1929, were estimated at 63,192 tons of smelting ore and 134,000 tons of concentrating ore. The company paid dividends amounting to 3,600,000 Chilean pesos during the year.

Kennecott Net Earnings Almost Doubled in 1928

NET INCOME of Kennecott Copper Corporation increased to $45,651,533 in 1928, from $23,890,044 in 1927, as a result of increased output and higher copper prices.

A consolidated statement of income follows:

Operating revenue:		
Copper		$82,921,165
Gold and silver		2,774,666
Railroads, steamships and wharf		6,168,058
Total operating revenue		$91,863,890
Operating costs:		
Cost of metal production, including mining, treatment and refining	$35,544,456	
Railroads, steamships, and wharf operating costs	4,581,936	
Total operating costs		40,126,393
Net operating revenue		$51,737,496
Other receipts:		
Dividends, interest and miscellaneous		4,756,150
Total income		$56,493,647
Deduct:		
Taxes	$6,365,599	
Depreciation	3,900,025	
		10,265,625
Net income for year		$46,228,022
Minority interest in income of subsidiaries		576,488
Net income applicable to Kennecott stock (after depreciation)		$45,651,533

Ore production from Alaskan operations was as follows:

	Tons	Per Cent Copper	Ounce, Silvers
Kennecott mine	74,688	12.50	2.440
Latouche mine	442,765	1.26	0.264
	517,453	2.88	0.578

Shipments to smelter amounted to 51,529 tons, containing 28,000,974 lb. of copper and 257,762 oz. of silver.

Smelter production at Braden was 218,273,782 lb. of copper. Smelter recovery was 97.25 per cent. A total of 5,174,017 tons of 2.247 per cent copper ore was milled during the year.

Gila County, Ariz., Taxes Paid Largely by Mines

More than half of the taxes paid in Gila County, Ariz., for the last half of 1928 were paid by mining companies. The total amount was $879,000, and of this Inspiration Copper Company contributed $313,266, Miami Copper Company, $207,463, International Smelter, $60,274 and the Old Dominion Mining Company $60,204. Outside of the mining companies the heaviest individual taxpayer was the Southern Pacific Railroad, which paid $30,164.

London Financial News

By W. A. Doman
Special London Correspondent

London, May 28, 1929 — Another stimulus has been given to Rhodesian copper shares during the last few days by the receipt of encouraging cablegrams from the Rhodesian Congo Border Concessions property. In one borehole the core assayed 9 per cent copper, and the sludge gave about half that quantity. The hole is said to have proved a length of 1,500 ft. on the strike. The £1 shares are now quoted above £9. Other shares have been taken up in sympathy, though to a smaller extent.

American interests have a working option over the old Cape Copper Mines, in Namaqualand. In the vicinity is the property of the Namaqua Copper Company, and Edward Hooper, the chairman, who has paid more than one visit to the mines, has arranged with the Americans for the use of the Port Nolloth Railway, by disposing of his company's surplus water. He states that the Minerals Separation plant has worked well.

Leslie Urquhart has come forward with a big scheme for his Russo-Asiatic and other mining properties. The Russo-Asiatic properties remain with the company of that name, while the other assets are transferred to a new undertaking styled the Mining Trust, Ltd. The Mining Trust has an authorized capital of £6,000,000, of which £3,000,000 is purchase consideration for 847,690 £1 fully paid shares in Mount Isa Mines, Ltd., Queensland, together with options on 194,195 shares until June 30, 1931, at £2 per share, and the right to subscribe to £1,000,000 of Mount Isa 7 per cent debentures, carrying the right until the same date to convert into shares at £2 10s. The Mining Trust will, in fact, acquire a 76 per cent interest in Mount Isa. It will also acquire 55½ per cent of the capital of the Mines de Villemagne, France, and 67 per cent of the capital of the Société des Mines de St. Sebastien d'Aigrefeuille; also, 500,000 shares of 5s. each in the Ellyou Goldfields Development Corporation, as well as the benefit of an agreement between North Charterland Exploration and Leslie Urquhart concerning exclusive prospecting rights in Northern Rhodesia until January, 1930. The Mining Trust will have a cash subscription of £1,500,000; 500,000 shares will be under option for two years at par, and 1,000,000 shares will be held in reserve.

On Wednesday last, Duncan Elliott Alves, chairman of the Panama Corporation, was banqueted on his return from the property. Hugh F. Marriott, who has also visited the property, spoke in the highest terms of its prospects and said he regarded it as the most promising mineral zone in the world. His speech made a great impression and the shares reached par (£1). People interested are now awaiting the result of the assay of the bulk samples that have been sent across, and that will, Mr. Marriott thinks, bear out his estimate of values.

Nitrate has again received a good deal of attention. Señor Santiago Sabioncello has through the Liverpool Nitrate Company acquired the control of the Salar del Carmen, subject of course to the sanction of the shareholders.

Anglo-Oriental Shows £220,228 Net Profit

TOTAL revenue of £235,087 is shown by the Anglo-Oriental Mining Corporation, one of the world's largest tin producing groups, in its first annual report, covering the period from February, 1928, when the company was incorporated, to February, 1929. Net profits, after deducting all charges, amounted to £220,228.

Directors have proposed a dividend of 15 per cent for the year on the corporation's ordinary shares and an additional participating and final dividend of 1¼ per cent on the 7½ per cent cumulative participating shares, making a total distribution on the latter of 8¾ per cent for the year. Issued capital of the corporation consists of £1,250,000 in 1,000,000 7½ per cent cumulative preference shares and 1,000,000 ordinary shares of five shillings each, fully paid.

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United States Metals Refining Company, subsidiary of American Metal, which operates a copper smelter and refinery at Carteret, N. J., has purchased the adjoining plant of the Chrome Steel Works. The purchase price is not stated.

San Rafael y Anexas, S. A., made a profit of 869,739 pesos during 1928, as compared with 703,127 pesos in 1927. This increase was made possible by a reduction in working costs, as both tonnage extracted and grade of ore showed decreases. The Hidalgo mines of the company were the only producing properties. Total amount of development work done at these mines during the year was 3,213 meters. Production amounted to 223,250 tons, of an average grade of 445 grams of silver and 2 grams of gold to the ton. Estimates of ore reserves at Hidalgo are 530,311 tons of an average grade of 430 grams of silver and 2 grams of gold. The mill treated an average of 725 tons daily during the period it was in operation. Recoveries were 90.6 per cent of the silver and 92.6 per cent of the gold. The product, after being refined by Real del Monte, was sold to the Mexican mint. Sales amounted to 90,133 kilograms of silver, equal to 2,897,863 oz., at an average price of 58.3c. per ounce. Gold production was 412 kilograms. In the mill the only change of importance was an adjustment of the Symons cone crusher to make a finer product. Mining costs in 1928 were 7.79 pesos per ton, compared with 10.03 pesos in 1927; milling costs were 3.80 pesos per ton, compared with 4.18 pesos in 1927; and other costs brought the total cost per ton up to 13.77 pesos per ton, compared with 16.40 pesos in the preceding year. In 1928, there were 8 fatal accidents and 30 serious accidents at the mine, compared with 9 fatalities and 95 serious accidents in 1927. Dividends paid by the San Rafael company during the year amounted to 660,000 pesos.

North Star Mines Company reports an operating loss of $55,733 in 1928. The year's output came chiefly from ore mined on and between the 6,900 and 8,600 levels on the so-called "X" vein, 7,200 and 8,700 levels on the new No. 3 vein, and 6,600 and 8,600 levels on the No. 2 vein. A total of 133,408 tons (including 14,525 tons from development) was delivered to the sorting plant, of which 24,808 tons was discarded as waste, leaving 108,600 tons crushed, with an average yield of $7.70 per ton crushed, at an average of $6.76 for operating costs, and $1.45 for development costs, making an aggregate cost of $8.21 per ton and resulting in a loss of 51c. per ton. The yield per ton in 1928 was 41c. less, and the cost per ton 19c. less, than in the previous year. Of the year's production 78.11 per cent was obtained by amalgamation, and 21.89 per cent by cyanidation. Tailing losses amounted to 29c. per ton crushed. The company reports that again this year it is forced to the conclusion that in these times of increased costs the ore is not available in sufficient quantity to effect a profit, after making provision for a proper rate of development of new ore reserves. However, in the past history of these properties, several times the outlook for profitable ore in sufficient quantity has been bad—but each time underground conditions took a turn for the better and the mine changed back from a developing prospect to a producer. It is to be hoped that this year the history of the North Star mine will be repeated in this respect.

Tonopah Belmont Development Company, operating the Belmont mine, at Tonopah, Nev., and the Belmont MacNeill mine, at Palo Verde, Ariz., has issued the following income account statement for the year ended Dec. 31, 1928:

Credits		
Net earnings of the mines for 1928 as reported by the mine offices		$37,983
Adjustments of earnings for prior years		355
Interest received		3,646
Total credits		$41,895
Debits		
Administration expenses	$25,010	
Taxes	1,555	
Shutdown expenses — Nevada Belmont	4,870	
Loss on sale of old stores	1,051	
		32,487
Net income on the business of the company for 1928		$9,497

There was mined and milled 21,093.81 dry tons of ore, of a gross metal content of $472,679.02, or $22.408 per ton, at the Belmont MacNeill mine in 1928. Net smelter returns, after deducting railroad freight, were $209,436.45, or $9.929 per ton.

Chase-Kennecott Merger Discussed

ACCORDING to Frederick S. Chase, president of the Chase Companies, fabricators of copper and brass products, recently merged with the Kennecott Copper Corporation, as another step in the integration of the copper industry, the subject of the merger was broached by Kennecott. Mr. Chase in explaining the situation to a group of company employees at Hartford, Conn., stated that the transaction was effected soon after the price of copper had risen to 24c. a pound, and when his company had been informed that there was some doubt as to whether it would be able to obtain enough of the metal, by working independently, to meet its demands. By merging with Kennecott, Mr. Chase said, his company insured that it would at all times be in a position to secure as much copper as it needed.

Chase Companies are fabricators mainly of brass products and tubes, consuming at present about 5,000,000 lb. of copper a month, and next year planning operations that will consume 10,000,000 lb. Kennecott Copper Corporation and the companies affiliated with it, including Nevada and Mother Lode, produce about 80,000,000 lb. of copper a month. Consequently it seems likely that Chase may prove to be only the first part of the fabricating subsidiary that Kennecott has under consideration.

WALKER MINING COMPANY, operating at Spring Garden, Plumas County, Calif., reports earnings during the first week of May at the rate of $140,000 monthly after deducting approximately $10,000 for development work. Estimated gross receipts for the first seven days of May were $58,000. Cost of mining, milling, development, and tramming averaged $2.70 a ton. Grade of the mill feed was increased to 2.02 per cent copper from 1.3 per cent copper for 1928. Movement of new mill equipment has been delayed by soft roads, but by July 1 the company expects to have its daily mill capacity increased from 1,200 tons to 1,600 tons.

E.&M.J. Weighted Index of Non-Ferrous Metal Prices

100 Is Composite for 1922-3-4

1920	130.92
1921	80.80
1922	93.94
1923	103.43
1924	102.63
1925	111.74
1926	107.74
1927	97.54
1928	99.78

	1927	1928	1929
January	100.46	97.54	106.86
February	100.01	96.73	110.37
March	100.84	96.22	122.71
April	98.63	97.14	116.36
May	96.41	99.05	110.03
June	95.55	100.16	.....
July	95.42	99.69	.....
August	97.25	99.85	.....
September	96.01	100.53	.....
October	95.36	102.34	.....
November	96.22	103.83	.....
December	98.30	104.28	.....

Tin Cartel Proposal Reported Under Way in London

A LETTER signed by representatives of more than fifty British companies with an annual output of more than 40,000 tons of tin, calling for unification of the tin-producing interests throughout the world with a view to stabilizing the industry, was made public in London recently. The letter, published in The London *Times*, confirmed recent rumors of the organization of a British tin cartel, with which the chief Bolivian and Dutch producers were expected to co-operate. If the Bolivian and Dutch tin mines join the cartel, the organization will control nearly two-thirds of the world's output of tin. Every important tin field in the British Empire, including those tin-producing concerns in Malaya, Burma, Siam, Nigeria and Australia, is reported to be represented in this most recent movement to stabilize the tin market.

Butte & Superior Income Shows Large Decline in 1928

EXHAUSTION of copper ore reserves is largely responsible for the decline in net income of the Butte & Superior Mining Company to $81,453 in 1928 from $272,911 in 1927.

Comparative Statement of Operations

	1928	1927
Operating revenue: Production of zinc and copper ore	$2,117,876	$2,670,697
Operating costs: Tonnage mined, 1928 — 272,253 tons; 1927 — 351,434 tons. Mining, development and general expenses	2,064,962	2,360,802
Net income from operations	$52,913	$309,894
Other income	62,351	55,758
Total income	$115,264	$365,652
Charges against income: Depreciation	.....	$36,000
Accrued taxes	$33,811	$56,741
	$33,811	$92,741
Net income (before depletion)	$81,453	$272,911

Surplus from Operations

Net income	$81,453
Credit excess reserves against book value of investments	278,199
	$359,652
Capital distributions	580,395
Excess of distributions to stockholders over credits to surplus during 1928	(a) $220,742
Balance of excess of distributions, Dec. 31, 1927	(a) 39,032
Excess of distributions to stockholders over surplus from operations, Dec. 31 1928	(a) $259,775

(a) Debit balance.

SANTA GERTRUDIS COMPANY, LTD., reports that for the quarter ended March 31, 1929, a total of 145,393 dry short tons of ore was milled. Total Santa Gertrudis, Inversions, and Dos Carlos revenue, after allowing for development and participation of owners but before deducting reserve for depletion and depreciation, was $394,919. Capital expenditure by the Dos Carlos company amounted to $11,020. The average price received for silver sold was $0.570 United States Currency per ounce 999 fine.

Current Statistics of Production and Stocks of Copper, Lead, and Zinc

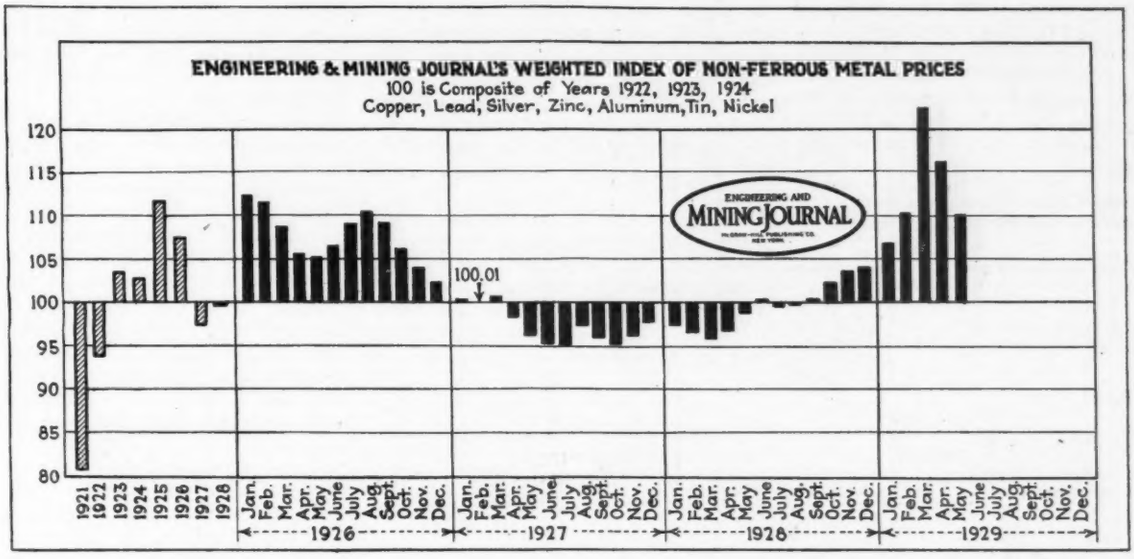
Data from American Bureau of Metal Statistics

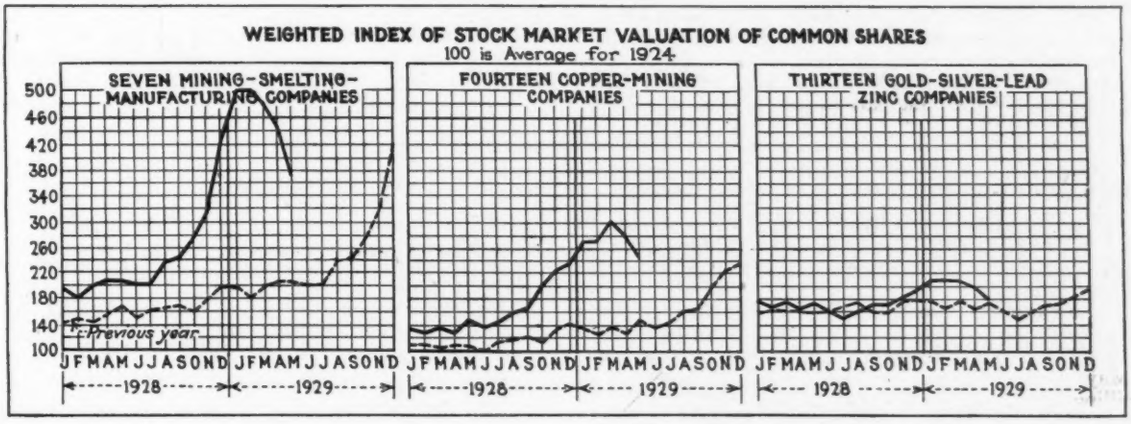
Figures Represent Short Tons

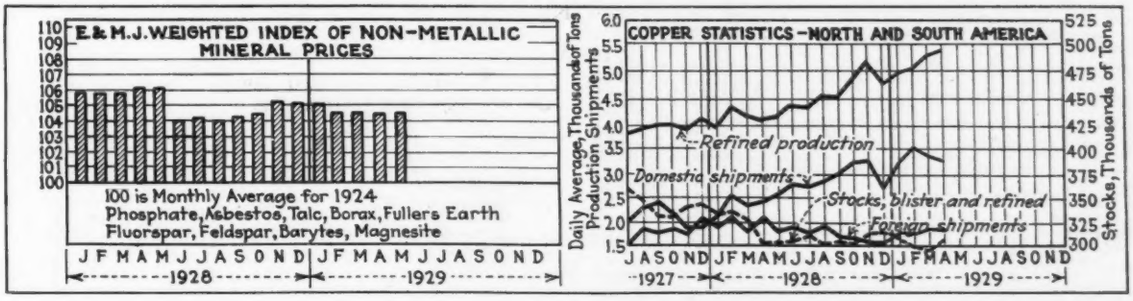
	1927	1928							1929				
COPPER—North and South America	Average	Jan.	Feb.	March	April	May	Dec.	Average	Jan.	Feb.	March	April	May
Production, refined, daily average	4,045	3,959	4,305	4,160	4,094	4,169	4,771	4,448	4,983	5,049	5,276	5,378	5,219
Domestic shipments	68,737	64,824	73,789	72,642	72,234	79,103	84,889	81,955	100,135	98,771	105,860	99,051	93,743
Foreign shipments	53,489	56,721	60,603	55,970	64,989	56,738	49,703	57,185	57,054	50,150	59,946	57,708	55,123
Stocks, blister and refined	335,311	318,137	318,161	313,408	291,985	291,743	315,461	300,771	307,959	296,298	295,309	311,996	331,655
LEAD—United States and Mexico													
Production, smelter, daily average	2,513	2,479	2,630	2,608	2,208	2,345	2,700	2,514	2,656	2,559	2,617	2,690	.....
Production, U. S. mines, daily average	1,798	1,755	1,896	1,872	1,671	1,661	1,846	1,785	1,891	1,723	1,648	.....	.....
Imports into U. S. A.	13,451	10,418	8,574	12,556	10,314	12,439	16,767	12,757	22,924	9,551	8,383	.....	.....
Stocks, smelter and refinery	156,878	157,417	167,692	173,411	161,207	159,375	161,460	160,511	156,182	160,597	158,683	156,484	.....
ZINC—United States													
Production, daily average	1,681	1,691	1,726	1,803	1,783	1,723	1,632	1,693	1,604	1,720	1,790	1,822	1,837
Domestic deliveries	45,811	45,771	46,754	51,856	46,517	49,818	49,625	48,301	47,677	51,057	56,267	56,558	56,614
Exports, slab zinc	3,468	4,644	2,125	2,558	2,620	2,148	(a)	(a)	(a)	(a)	(a) —	(a)	.....
Exports, ores and dross	4,424	2,444	890	1,898	155	361	587	453	545	165	483	308	.....
Stocks	37,602	42,163	41,290	41,529	44,759	45,225	45,441	44,333	45,418	40,620	37,962	34,588	33,826
World Production Rate (Daily Average)													
Copper	4,543	4,631	5,088	4,769	4,881	5,046	5,782	5,236	5,767	5,968	6,219	6,547	.....
Lead	4,514	4,859	5,067	5,158	4,868	4,774	5,265	4,976	5,037	5,068	5,176	5,391	.....
Zinc	3,910	4,179	4,285	4,394	4,352	4,248	4,426	4,271	4,231	4,357	4,448	4,537	.....

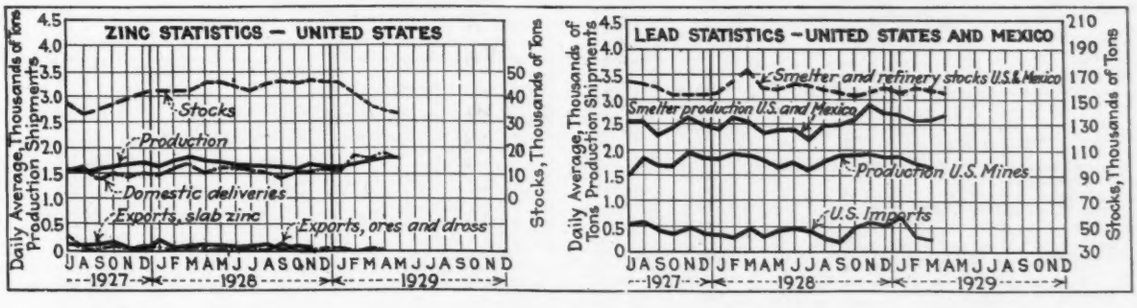
(a) Withheld pending investigation of government reports.

E. & M. J. Statistics of the Mining Industries






E. & M. J. WEIGHTED INDEX OF NON-METALLIC MINERAL PRICES
100 is Monthly Average for 1924
Phosphate, Asbestos, Talc, Borax, Fullers Earth
Fluorspar, Feldspar, Barytes, Magnesite
COPPER STATISTICS - NORTH AND SOUTH AMERICA
Refined production
Domestic shipments
Stocks, blister and refined
Foreign shipments
Daily Average, Thousands of Tons Production Shipments
Stocks, Thousands of Tons
1927
1928
1929



Andes Copper Had Net Income of $3,933,721 in 1928

OPERATIONS at the Andes Copper mining Company, Anaconda subsidiary, situated at Potrerillos, Chile, were expanded considerably in 1928 by the starting of the company's electrolytic leaching plant and refinery. Net income for the year amounted to $3,933,721, as shown in the following income statement:

Andes Copper Mining Company
Consolidated Income Account for 1928

Operating revenue:		
Copper sold—88,926,898 lb.		$13,555,544
Production cost, less value of silver and gold		5,676,683
Operating profit		$7,878,861
Other income		252,968
		$8,131,830
Charges against income:		
Taxes and miscellaneous charges	$1,570,527	
Interest, including discount on debentures	2,077,581	
For depreciation of plant and equipment	550,000	4,198,109
Net income		$3,933,721

The metallurgical plant for the treatment of sulphide ores operated satisfactorily both metallurgically and mechanically. December averaged 14,700 tons of ore treated per day, and at present in excess of 15,000 tons per day is being handled. The metallurgical plant for the treatment of oxidized ores started operation in the second quarter of the year, but the plant was not completed until the following quarter.

Blister copper containing 92,469,586 lb. of fine copper, 222,675 oz. of silver, and 14,477 oz. of gold was produced by the sulphide plant during the year. The leaching plant produced wire bars amounting to 11,587,471 lb. of fine copper, making the total production for the year 104,057,057 lb., of which 119,083 was used in the plants of the company.

On Nov. 8, 1928, notice was given by the company that all of its convertible 7 per cent debentures outstanding would be called for redemption on Jan. 1, 1929, and the entire issue has been converted. The ore mined during the year was as follows:

	Short Tons	Per Cent Copper
Sulphide ore to the reduction works	3,865,400	1.51
Oxidized ore to the leaching plant	807,976	1.48
Oxidized ore to the converters	6,426	4.14
Oxidized ore to storage	1,179,268	2.73
Total	5,859,070	1.75

In addition to the above a total of 921,390 tons of waste material overlying the central oxide orebody was removed.

The concentrator treated 3,849,337 tons of ore, having an average copper content of 1.51 per cent. Concentrates produced amounted to 170,717.69 dry tons, having an average copper content of 28.233 per cent. Recovery in concentration was 82.931 per cent of the total copper and 93.869 per cent of the sulphide copper contained in the ore. The first oxidized ore to be leached was passed through the crushing plant in April, and leaching was started in June. Difficulties were encountered in obtaining uniform percolation of leaching solutions through the charge because of an excessive amount of fines. After considerable experimental work it was found necessary to remove the fines and store them for future treatment by special methods. This procedure resulted in uniform leaching operation, with satisfactory recoveries, so that the plant is now operating at approximately 93 per cent of its rated capacity, which will be brought up to capacity upon the installation of additional equipment in the acid manufacturing plant. A total of 638,784 tons of ore, having an average copper content of 1.481 per cent, was leached during the year.

Construction during 1928 comprised the completion of the metallurgical plant for the treatment of oxidized ore; installation in part of a fifth boiler at the Barquito power plant; completion of erection of 72 dwellings and erection in part of 72 additional dwellings, and erection of a locomotive and car repair shop for the mine to mill railroad.

Imports and Exports of Ores and Metals in April, 1928 and 1929

Compiled from U. S. Department of Commerce Records

In Pounds, Unless Otherwise Stated

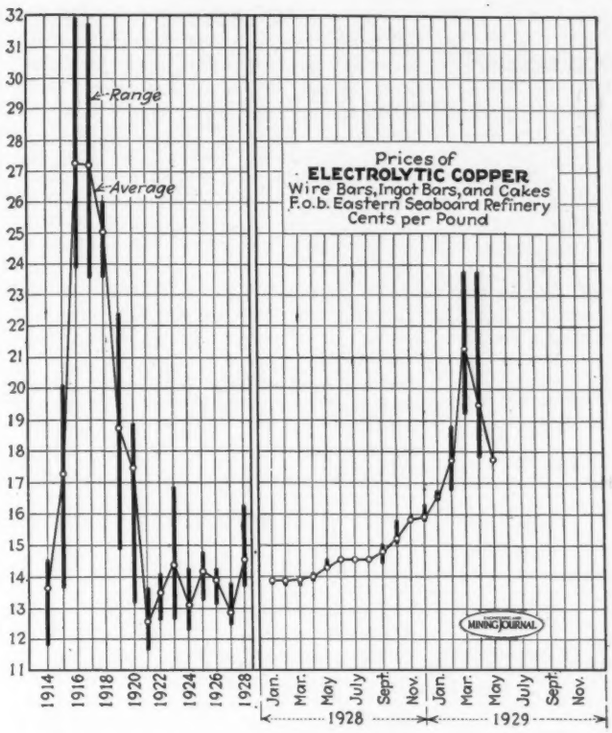
Imports

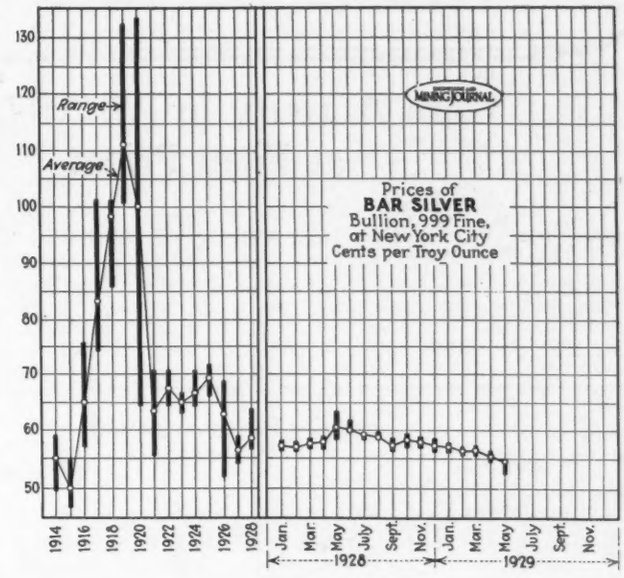
	April 1928	April 1929
Antimony		
Ore, Gross weight	385,233	1,331,230
Ore, Antimony content	211,539	788,606
Copper		
Ores, copper content	11,068,578	8,900,198
Concentrates, copper content	1,727,810	5,505,781
Regulus, coarse metal, cement copper	339,500	110,582
Imported from:		
Spain	831,196	1,209,920
Canada	2,695,522	3,374,976
Mexico	3,305,330	2,577,910
Cuba	1,745,506	878,685
Chile	4,206,927	4,215,724
Peru	154,557	767,073
Other countries	196,856	1,492,273
Unrefined converter copper in pigs, bars, and other forms	46,379,106	49,694,017
Refined copper	3,051,500	13,099,407
Old and clippings	542,188	1,236,275
Composition metal	.....	14,120
Brass, old, for remanufacture	326,958	1,735,246
Lead		
Ore and matte, lead content	2,343,655	921,107
Bullion or base bullion	18,284,252	13,301,425
Pigs and bars, old, and scrap	782	8,805
Babbitt, solder, other forms, Lead content	27,340	138,704
Babbitt, solder, other forms, Gross weight	61,019	270,286
Type metal, antimonial lead, Lead content	85,787	93,283
Type metal, antimonial lead, Gross weight	111,994	111,994
Manganese, tons		
Cuba, manganese content	77	151
Other countries, manganese content	14,074	30,577
Pyrites, tons	32,279	38,781
Tin, ore, tons	51	11
Bars, blocks, pigs	15,502,671	19,798,192
Imported from:		
Netherlands	784,528	1,572,429
United Kingdom	3,987,311	3,880,927
British Malaya	8,572,529	13,124,951
Netherland East Indies	112,200	233,000
Hongkong	1,351,303	593,691
Australia	100,800	90,600
Other countries	594,000	302,594
Zinc		
Ore, zinc content, Free	.....	.....
Ore, zinc content, Dutiable	212,500	188,700
Blocks, pigs and other forms, old	.....	100

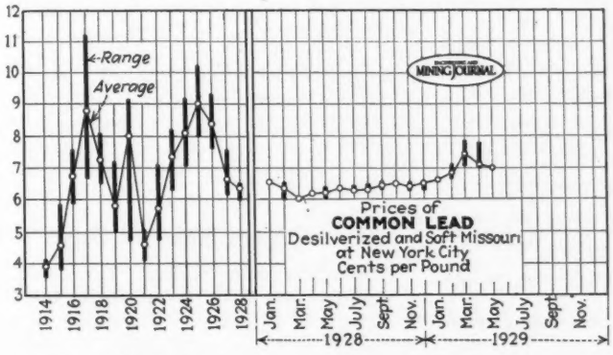
Exports

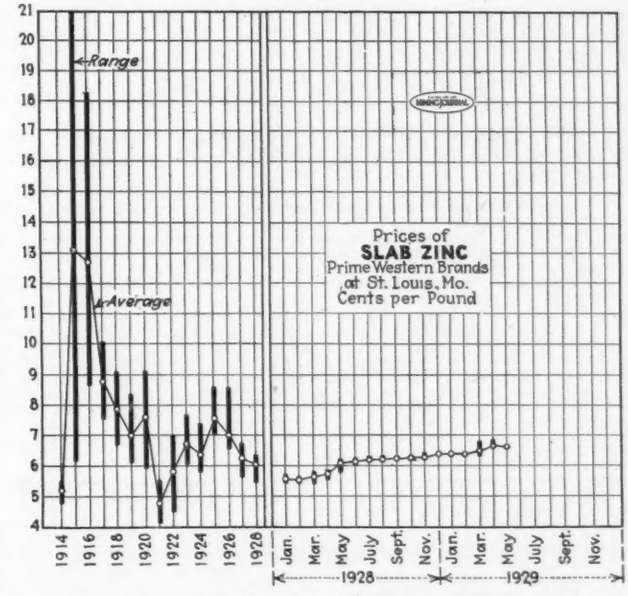
	April 1928	April 1929
Copper		
Ores, composition, concentrates, unrefined	374,271	4,358,730
Refined copper in ingots and other forms	80,077,621	78,862,804
Exported to:		
Belgium	7,424,841	4,673,349
France	9,720,643	18,955,094
Germany	18,713,728	18,939,562
Italy	5,996,197	8,237,097
Netherlands	5,987,812	1,847,237
Spain	.....	358,721
Sweden	2,799,420	2,984,410
United Kingdom	13,172,634	13,132,470
Other Europe	9,289,568	369,674
Canada	1,005,971	5,128,266
British India	336,016	56,014
China, Hongkong, Kwantung	1,106,149	112,085
Japan	4,403,248	3,583,220
Other countries	121,394	485,605
Old and scrap	4,686,588	4,831,723
Pipes and tubes	249,626	363,948
Plates and sheets	247,607	525,987
Rods	4,478,774	5,906,155
Insulated copper wire and cable	1,031,239	1,672,080
Lead		
In pigs, bars, and other forms		
From domestic ore	48,775	3,910,579
From foreign ore	18,909,481	7,049,695
Exported to:		
Belgium	.....	672,218
France	1,456,372	.....
Germany	2,251,905	179,235
Netherlands	448,157	515,360
Sweden	392,420	1,479,158
United Kingdom	5,937,812	4,817,482
Other Europe	1,286,879	793,125
Brazil	224,035	224,077
Other South America	190,256	3,125
China, Hongkong, Kwantung	392,376	448,711
Japan	6,275,288	1,569,132
Other countries	102,754	258,651
Other lead manufactures	1,182,603	1,820,845
Zinc		
Ores and concentrates, tons	.....	.....
Dross	360,849	615,187
Cast in slabs, blocks and pigs	5,239,993	3,006,838
Exported to:		
Belgium	55,990	60,364
France	1,344,277	1,120,282
Germany	656,479	1,103,766
Italy	448,053	.....
Netherlands	113,933	50,026
United Kingdom	55,987	223,930
Other Europe	280,078	56,034
Japan	1,411,167	54,100
Other countries	874,029	338,336
Sheets, strips and other forms	646,480	808,839
Dust	239,774	129,352
Other zinc manufactures	91,352	152,777

Metal Price Curves

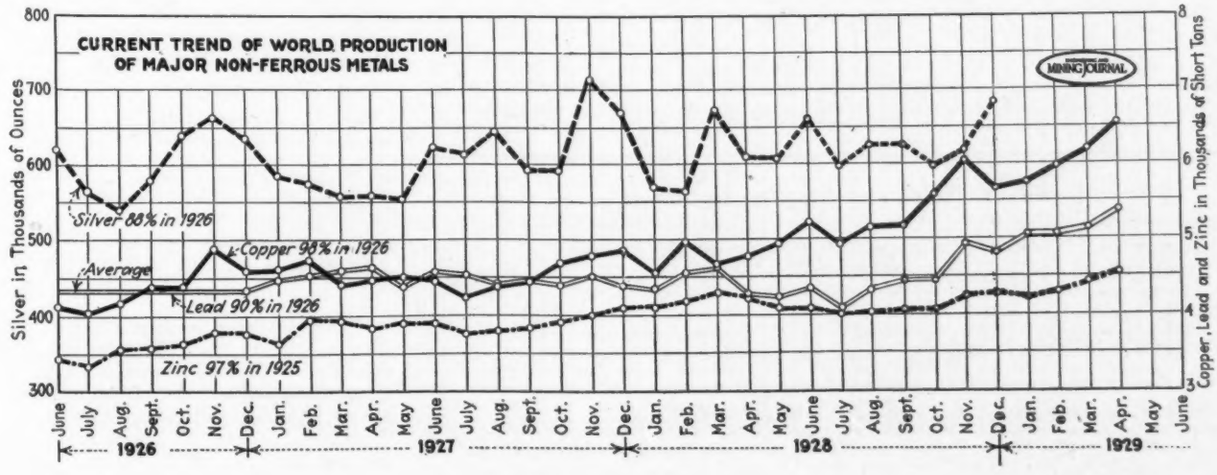








THE CURVES below are not to be considered as permanent records of production. They show merely the current trend in terms of daily output according to the latest estimates of the American Bureau of Metal Statistics. The figures represent production from countries that produce approximately 98 per cent of the world's copper, 97 per cent of the zinc, 90 per cent of the lead, and 88 per cent of the silver. The figures for lead on the new basis are not available for the individual months of 1926, and accordingly the horizontal line showing the monthly average reduced to a daily rate is shown. Delay in receipt of statistics from Mexico accounts for the failure of the silver curve to be up to date.


CURRENT TREND OF WORLD PRODUCTION
OF MAJOR NON-FERROUS METALS
MINING JOURNAL
Silver in Thousands of Ounces
Copper, Lead and Zinc in Thousands of Short Tons
Silver 88% in 1926
Average
Copper 98% in 1926
Lead 90% in 1926
Zinc 97% in 1925
June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June
1926
1927
1928
1929

The Market Report

More Activity in All Metals at Firm Prices

New York, June 12, 1929.—More copper, lead, zinc, and tin have been sold since last Wednesday than for many weeks. This is not to say that a buying wave of any great magnitude is on, for business has been meager for some time, but it does indicate that consumers' stocks have reached the point where additional supplies must be ordered for early use. Most of this metal has been for prompt shipment and at unchanged prices, though tin has advanced fractionally largely as a result of speculative buying.

Daily Prices of Metals

June	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
6	17.775	43.875	7.00	6.75@6.80	6.60
7	17.775	44 00	7.00	6.75@6.80	6.60
8	17 775	44 25	7.00	6.75@6.80	6.60
10	17.775	44 75	7.00	6.75@6.80	6.60
11	17.775	44 50	7.00	6.75@6.80	6.60
12	17 775	44.125	7.00	6.775@6.80	6.625@6.65
	17 775	44.250	7.00	6.777	6.606

Average prices for calendar week ending June 8, 1929, are: Copper, 17.775; Straits tin, 43.875; N. Y. lead, 7.000; St. Louis lead, 6.775; zinc, 6.642; and silver, 52.042.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.

Quotations for copper are for the ordinary forms of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cables, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

June	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic bid						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
6	74 5/16	74	84½	198	201½	23 11/16	23 11/16	26½	26⅜
7	75	74 9/16	84¼	199⅜	202⅜	23⅝	23⅝	26 7/16	26¼
10	75¾	75⅛	84¼	200⅛	203⅛	23 9/16	23 9/16	26⅜	26⅜
11	76⅜	75⅜	84¼	202¼	205¼	23 9/16	23⅝	26 7/16	26 1/16
12	74⅜	74	84¼	200⅝	203¾	23½	23 7/16	26 3/16	26 1/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

June	Sterling Exchange "Checks"	Silver		Gold London	June	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
6	4.84 7/16	51¾	24	84s11½d	10	4.84⅜	52⅜	24 5/16	84s11½d
7	4.84½	52⅛	24	84s11½d	11	4.84⅜	52⅜	24½	84s11½d
8	4.84 5/16	52¼	24 3/16	.....	12	4.84⅜	52¾	24⅜	84s11½d

Average: Silver, 52.271c.; Sterling Exchange, 484.396c.

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of silver, 999 fine. London silver quotations are in pence per troy ounce of bar silver, basis 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Copper Interest Reviving, Especially Abroad

The position of buyers is unchanged, all sellers quoting 18c. for Eastern deliveries, but with the large producers keeping out of the market except for a small tonnage of special shapes that they alone can supply. The custom smelters have shared the bulk of the business, which has not been large, though better than for any week since that of April 17. A third of the demand has been for June and another third for July shipment. Foreign demand has improved considerably, especially from Germany and England, at the unchanged price of 18.30c., c.i.f. Already more has been sold in the export market than during the entire month of May. Consumers continue to report a considerable apathy on the part of buyers of manufactured goods, but orders are improving, especially for wire. It is the expectation that there will be good average buying of copper for fairly prompt shipment throughout the summer, rather than that there will be a huge buying wave of short duration.

The statistics for May were released today and variously interpreted. Total refinery production of 161,784 tons is almost exactly the same as for April, which was to have been expected as any curtailments made at the mines will not be reflected in refinery production so soon. Export shipments were 55,123 tons, compared with 57,708 for April, and domestic shipments 93,743 tons, compared with 99,051 for April. Stocks of refined copper increased from 57,494 to 70,412 tons, and of blister from 253,509 to 261,243 tons. A somewhat larger increase in stocks had been predicted.

Some Heavy Sales of Zinc

Those producers holding for 6.80c. continue unsuccessful in marketing their product except for an occasional carload, but offers at from 6.55 to 6.65c. have been accepted quite freely during the last week—so much so, in fact, that the total volume of business has been the greatest since March. Some of the larger orders have been for July to October delivery, with the more numerous smaller orders for prompt shipment.

Stocks of zinc declined slightly during May, according to the American Zinc Institute, even though production was somewhat higher than in April. The statistics, in tons of 2,000 lb., follow:

Stock, May 1	34,588
Produced	56,958
Shipped	57,720
Stock, May 31	33,826
Shipped from plants for export	1,106
Total retort capacity, May 31	119,786
Average number retorts operating in May	73,485

Sales of twelve leading companies in May amounted to 2,666 tons for May delivery at 6.636c., and 3,953 tons for subsequent delivery at 6.616c., an average of 6.624c., according to the Zinc Institute. *E.&M.J's.* average for May was 6.618c.

Lead Demand Improves

Considerable improvement has been noted in the lead market during the last week. Small orders and carload lots have been booked in quantity, the larger part of which has been for June shipment. The volume of sales is considerably more than that of an average week, being the largest in nearly three months, or since the week ended March 20. Demand has come from a variety of consuming interests—in fact, virtually every important consuming group has been fairly well represented, except lead-covered cable manufacturers, who are expected to enter the market on a good scale in the near future.

Price in New York continues unchanged at 7c. per pound, which is also American Smelting & Refining's contract price. In St. Louis a tendency toward firmness has been noted, though prices are but little changed. Early this week one seller, finding himself somewhat undersold, rounded out his books in fair shape by the sale of quite a large tonnage for July and August shipment at the 6.75c. price. It is doubtful, however, if lead in St. Louis could be had today for less than 6.775c.

Tin More Active

Speculative interests have been reported as operating in the tin market in the last week, resulting in an advance of nearly 1c. per pound in four days, though subsequently the price declined. Recent tin-stabilization propaganda from London has caused no particular disquietude in the trade here. The opinion is quite generally held that legitimate stabilization might work to the benefit of all concerned, though doubt is expressed in some quarters as to the possibility of the present movement becoming any more effective than earlier attempts in the direction of stabilization.

Silver Higher and Steady

The silver market has shown steady improvement during the last week, advancing from 51¾c. on June 6 to 52¾c. on June 12. Purchases to cover bear accounts combined with buying by China and India have been the cause of the gradual rise. The market closes steady.

Mexican Dollars (old Mexican pesos): June 6th, 39⅜c.; 7th, 39½c.; 8th, 39⅜c.; 10th and 11th, 39¾c.; 12th, 40c.

Foreign Money Unchanged

Variations in foreign exchange have been inconsequential. Closing cable quotations on Tuesday, June 11, follow: Francs, 3.90⅞c.; lire, 5.23⅞c.; and marks, 23.845c. Canadian dollars, ⅛ of 1 per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c.

ANTIMONY—Per lb., duty paid, New York: Chinese brands, 8⅞@9c. per lb. for all positions. Cookson's "C" grade, spot, 14c.

BISMUTH—Per lb., New York, in ton lots, $1.70. Smaller lots, $1.85 and up.

CADMIUM — Per lb., New York: 80@95c. Active demand.

IRIDIUM — Per oz., $230@$240 for 98@99 per cent sponge and powder.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 35c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $38@$40. Small lots bring up to $50. Nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, $68 per oz. Transactions between dealers and refiners in the outside market are commonly reported at several dollars less.

QUICKSILVER — Per 76-lb. flask. $120@$121. Small lots command the usual premiums.

Prices of Chromium, Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Titanium, Tungsten, Vanadium, and Zirconium are unchanged from the issue of June 8.

Metallic Ores

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Wolframite, $15@$15.50; Western scheelite, $15.50, for future delivery based on present tariff. Nominal.

Antimony, Chrome, Iron, Manganese, Tantalum, Titanium, Vanadium, and Zircon ores are unchanged from quotations in the June 8 issue.

Joplin Reports Improved Demand for Both Zinc and Lead

Joplin, Mo., June 8, 1929

Blende

	Per Ton
High	$46.10
Premium blende, basis 60 per cent zinc	$44.00@ 45.00
Prime Western, basis 60 per cent zinc	43.00@ 44.00
Table concentrates, 60 per cent zinc	41.00@ 43.00
Flotation concentrates, 60 per cent zinc	39.00@ 41.00
Average settling price, all zinc concentrates	43.99

Galena

High	$92.10
Basis 80 per cent lead	90.00
Average settling price, all lead concentrates	91.07

Shipments for the week: Blende, 12,241 tons; lead, 1,437 tons. Value all concentrates the week, $669,470.

The purchasing agents were in the market for an increased tonnage of zinc concentrate at unchanged prices, and contracted for shipment of approximately 12,800 tons for next week, an equivalent of the current output. Demand for lead concentrate was strengthened by the better tone of the pig lead market, but sellers were not anxious to accept offers with no advance in the price.

Mergers are being effected whereby several small properties are being consolidated into strong and larger organizations, and rumors that Anaconda is negotiating for a prominent position in this district continue in circulation. They appear to be based entirely on the presence in the district recently of representatives of that company.

Platteville, Wis., June 8, 1929

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$46.75
Lead Ore	
Lead, basis 80 per cent	$90.00

Shipments for the week: Blende, 654 tons; lead, none. Shipments for the year: Blende, 15,343; lead, 760 tons. Shipments for the week to separating plants, 1,680 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the June 8 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic) Per lb., 4c. Market more active.

Antimony Oxide, Calcium Molybdate, Copper Sulphate, Sodium Sulphate, Sodium Nitrate, and Zinc Oxide are unchanged from prices in the June 8 issue.

Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $105. Spiegeleisen, 19@21 per cent, $33@$34 f.o.b. furnace.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent W, $1.35@$1.50 f.o.b. works. Market strong.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferrovanadium, Nickel Silver, and Yellow (Muntz) Metal are unchanged from prices in the June 8 issue.

Rolled Metals

Copper, Lead, Zinc, Monel Metal, and Nickel Sheets are unchanged from prices in the June 8 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of June 8.

Iron, Steel and Coke

IRON—Per gross ton, Valley furnaces, Bessemer, $19; basic, $18.50; No. 2 foundry, $18.50.

STEEL—Base prices per gross ton Pittsburgh, billets and slabs, $35@$36; plates, structural shapes, and soft steel bars, per 100 lb., $1.95.

COKE—Per gross ton, Connellsville furnace, $2.75@$2.85. Connellsville foundry, $3.75@$4.85. Byproduct coke, Ohio and Kentucky (Connellsville basis) $6.50; Buffalo and Detroit, $8.50@$9.

Mining Stocks—Week Ended June 8, 1929

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	108	103	104⅜	Mr.29,My.20 Q	1.75
Andes Copper	New York	51⅛	46⅜	50½	Mr.29, My.6 Q	0.75
Arizona Com	Boston	3½	2⅞	3¼	Ja. 16, Ja. 31 SA	0.25
Calumet & Aris	New York	132⅜	126⅛	128	My.31, Je.17 Q	2.50
Calumet & Hecla	Boston	44⅜	39½	43½	My.31, Je.29 Q	1.00
Cerro de Pasco	New York	99¼	90	95½	Ap.11, My. 1 Q	1.50
Chile Copper	New York	...	...	86⅜	Je. 1, Je.28 Q	0.87½
Con. Coppermines	N. Y. Curb	10⅛	10	10⅛		
Copper Range	Boston	25¼	20	23¾	Je. 15, Jl. 15 Q	0.50
East Butte	Boston	3½	3	3	Dec., 1919	0.50
Granby Con	New York	75⅛	69½	73½	Ap.12, My.1 Q	1.75
Greene Cananea	New York	150⅜	138	146	Je. 6, Jl. 1 Q	2.00
Howe Sound	New York	64	59	62	Mr. 30, Ap. 15 Q	1.00
Hudson Bay	N. Y. Curb	17⅜	16½	17½		
Inspiration	New York	45⅜	41⅛	44	Je.13, Jl. 1 Q	1.00
Isle Royale	Boston	24	21	23½	My. 31, Je.29	0.50
Kennecott	New York	86⅜	81⅛	82½	My. 31, Jl. 1 Q	1.25
Magma Copper	New York	69½	64½	65½	Mr.30, Ap.16 Q	1.25
Mason Valley	N. Y. Curb	1⅛	1⅛	1⅛		
Miami Copper	New York	43½	39	41½	My1, My15 Q	1.00
Mohawk	Boston	55½	53	55½	Ap. 30, Je. 1 Q	1.50
Mother Lode	New York	3½	3½	3⅜	Je. 13, Je. 29	0.20
Nevada Con	New York	47⅜	43½	45⅜	Je. 14, Je. 29 Q	0.75
Noranda	N. Y. Curb	54⅜	49½	52⅜		
Ohio Copper	N. Y. Curb	2½	1⅜	2⅜	Sept., 1926	0.03
Old Dominion	Boston	11½	9½	11½	Dec., 1918	1.00
Phelps Dodge	New York	66	62	64⅜	Je. 4, Jl. 1 Q	0.75
Quincy	Boston	38½	34½	38	March, 1920	1.00
Roan Antelope	N. Y. Curb	47	44½	44½		
St. Mary's M. L.	Boston	38⅜	31½	38	Fe.25, Mr.12	2.00
Seneca Copper	New York	6⅜	5	5⅜		
Shattuck Denn	N. Y. Curb	18⅜	16⅜	17		
Sherritt-Gordon	Toronto	7.40	7.00	7.35		
Tenn. C. & C.	New York	18⅜	17	18½	My.31, Je.15 Q	0.25
United Verde Ex	N. Y. Curb	18½	18	18	Ap. 4, My. 1 Q	1.00
Utah Copper	New York	290	290	290	Je. 14, Je. 29 Q	4.00
Waite-Ack.-Mont	Toronto	4.15	3.90	4.15		
Walker Mining	Salt Lake	3.85	3.70	3.85		
Wenden Copper	N. Y. Curb	1⅛	1⅛	1⅛		
LEAD, ZINC, SILVER						
Ahumada Lead	New York	2⅜	2⅛	2⅛		
Amer. Z. L. & S.	New York	31⅛	26½	29	May, 1917	1.00
A. Z. L. & S., pfd.	New York	99	99	99	Je.14, Jl. 1	1.50
Bingham Mines	Boston	52	52	52	Mr.15, Ap.5	0.50
Bunker Hill & S.	N. Y. Curb	138	138	138	Ap.25, My.6 X	0.75
Butte Cop. & Zn.	New York	5⅜	4⅜	4⅜		
Butte Cop. Con.	Boston Curb	*37	*30	*31		
Butte & Sup.	New York	8	6⅜	7⅜	Je. 14, Je. 29 Q	0.50
Callahan Zn-Ld.	New York	2	1⅛	1⅛	Dec., 1920	0.50
Chief Consol.	Salt Lake	3.00	2.85	2.90	Fe. 1, 1928 K	0.10
Consol. Ld. & Zn. "A"	St. Louis	15⅛	13⅛	15½	Ap.5, Ap.10	0.25
Constitution	Spokane	*37⅛	*37⅛	*37⅛		
Dayrock	Spokane	*2.80	*2.50	*2.50	Je.20, Je.30	0.03
Dickens Consol.	Spokane	*5⅛	*4⅛	*4⅛		
Eagle-Picher	Cincinnati	16⅛	16⅛	16⅛	Je. 30, Jl.15 Q	0.20
Eagle-Pich., pfd.	Cincinnati	...	...	102	Je. 30, Jl. 15 Q	1.50
Erupcion	Boston Curb	*15	*15	*15	Ja. 1, 1928 Q	0.07½
Eureka Bullion	Salt Lake	*90	*74	*74		
Eureka Lilly	Salt Lake	...	...	1.42½		
Eureka Standard	Salt Lake	...	...	3.32½		
Evans-Wallower	N. Y. Curb	19⅛	16⅜	19		
Evans-Wal., pfd.	N. Y. Curb	...	...	84½	Mr.20, Ap.1 Q	1.75
Federal M. & S.	New York	...	...	217	Je., 1927	10.00
Fed. M. & S., pfd.	New York	99⅜	99½	99⅝	My.24, Je.15 Q	1.75
Gladstone	Spokane	*11¼	*11	*11		
Golconda	Spokane	1.35	1.16	1.25	Je.15, Jl.1	0.02
Grandview	Spokane	36½	34⅜	35		
Hecla Mining	N. Y. Curb	17⅞	17⅝	17⅞	My.15, Je.15 Q	0.25
Highland-Surprise	Spokane	*15½	*14⅜	*14½		
Jack Waite	Spokane	*10	*7½	*8½		
Kootenay Florence	Spokane	*14	*11	*14		
Lucky Jim	Spokane	*12	*12	*12		
Lucky Tiger-C.	Kansas City	†4.25	†3.75	....	De.4, De.20 MX	0.12
Mexican Premier	Spokane	2.45	2.18	2.44		
National Lead	New York	1.45	1.42	1.45	Je. 14, Je. 29 Q	1.25
Natl. Lead, pfd. A	New York	140	140	140	Mr. 1, Mr. 15 Q	1.75
Natl. Lead, pfd. B	New York	118	118	118	Jy. 19, Au 1 Q	1.50
N. J. Zinc, new	N. Y. Curb	80	79	79	Je.1, Je.14 X	0.50
New Quincy	Salt Lake	2.22½	2.05	2.10	My.15, My.27 Q	0.10
Noble Five	Spokane	*58	*55	*55		
North Lily	Salt Lake	8.15	7.60	7.60	Jan. 20 Q	0.25
Park Bingham	Salt Lake	9.50	7.00	9.00		
Park Utah	New York	8⅛	7⅞	8	Mr. 19, Ap. 10 Q	0.20
Pend Oreille	Spokane	5.00	4.80	5.00		
Rico Argentine	Salt Lake	*34	*30	*34	No. 30, De. 15 Q	0.03
Ruth-Hope	Spokane	*30	*25	*30		
St. Joseph Lead	New York	72	67½	68	Ju. 8, Ju.20 QX	0.75
Sherman Lead	Spokane	*32½	*30	*32		
Silver King Coa	Salt Lake	13.25	13.00	13.00	Mr. 20, Ap. 1 Q	0.25
Silversmith	Spokane	*14⅜	*13	*13	Oct., 1926 Q	0.02
Sunshine Mining	Spokane	3.03	2.45	3.02	Je. 10, Je. 20 BM	0.05
Tamarack-Custer	Spokane	*65	*61	*62½	Sept., 1924	0.25
Tintic Standard	Salt Lake	13.50	13.12½	13.12½	De. 23, Ja. 23 X	0.20
Tonopah Belmont	N. Y. Curb			*56½	Oct., 1925	0.05
Treadwell-Yukon	Toronto	10.75	10.50	10.75		
Unjted Zinc Smg	N. Y. Curb	*68⅜	*62⅛	*68⅜		
Utah Apex	Boston	3⅜	3 1/16	3⅜	May 15, June 1	0.25
Utah Met. & Tun.	Boston	1¼	1	1¼	Dec., 1917	0.30
Whitewater	Spokane	*72	*70	*70		
Yellow Pine	Los Angeles	..	....	*8	Dec., 1925 QX	0.04
GOLD						
Alaska Juneau	New York	6	4¼	5⅛		
Barry-Hollinger	Toronto	*35	*25	*30½		
Central Manitoba	Toronto	*50	*31	*48		
Coniaurum	Toronto	*40	*40	*40		
Cresson Consol.	N. Y. Curb	*75	*68⅜	*75	Mr.30, Ap.10 Q	0.02
Dome Mines	New York	9⅛	9⅛	9⅛	Mr.30, Ap..20 Q	0.25
Golden Cycle	Col. Springs	†1.95	†1.85	....	Fe.15, Mr. 1	0.04
Gold Hill	Toronto	*3½	*2½	*3		
Hollinger	Toronto	6.00	5.75	6.00	Je.20, Je. 25 M	0.05
Homestake	New York	76	75½	75½	My.20, My.25 M	0.50
Kirkland Lake	Toronto.	*90	*85	*89		
Lake Shore	Toronto	24.00	22.50	23.25	Je.1, Je.15 Q	0.20
McIntyre-Porc	New York	16½	16½	16½	My.1, Je.1 Q	0.25
Portland	Colo.Springs	†*12	†*10½	....	April, 1927	0.02
Rand Mines	New York	...	...	35	Fe. 21,'28 Am.Sh.	1.52
Siscoe	Toronto	*65	*54	*63		
Sylvanite	Toronto	1.35	1.25	1.30		
Teck-Hughes	Toronto	8.40	8.10	8.15	Ap. 7,My 1, O	0.15
Tom Reed	Los Angeles	....	....	*25	Dec., 1926	0.02
Unity Gold	N. Y. Curb	1⅛	1⅛	1⅛		
Vipond Consol	Toronto	*87	*84	*86	April, 1927	0.03
Wright-Hargreaves	Toronto	1.40	1.30	1.35	Oc. 16, No. 1	0.02½
Yukon-Alaska	N. Y. Curb	....	....	35⅛		
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	17⅞	15⅛	17⅞		
Castle-Trethewey	Toronto	*33	*30	*33		
Consol. Cortes	N. Y. Curb	....	....	*18⅛		
Dolores Esperanza	N. Y. Curb	*81½	*81½	*81½	July, 1923	0.05
Keeley	Toronto	*50	*43	*46	Mr.15, 1928	0.04
Mining Corp.	Toronto	4.35	3.90	4.30	My 30, Je.13	0.12½
Montana-Idaho	Spokane	*10½	*9½	*10		
N. Y. & Hond. Ros.	N. Y. Curb	....	....	17⅜	Ap.17,Ap.27 QX	0.05
Nipissing	N. Y. Curb	2⅜	2⅜	2⅜	Mr.30,Ap.20 Q	0.07½
Premier Gold	N. Y. Curb	1⅜	1⅜	1⅜	Mr.14, Ap.4	0.06
Tonopah Exten	N. Y. Curb	....	....	*10	April, 1925	0.05
Tonopah Mining	N. Y. Curb	3	3	3	Ap. 7, Ap. 20	0.07½
United Eastern	N. Y. Curb	*50	*31½	*31½		
Yukon Gold	N. Y. Curb	*93⅜	*56½	*93½	June, 1918	0.02
IRON AND STEEL						
Bethlehem Steel	New York	103½	95½	99	Jl.19, Au.15 Q	1.00
Beth. Steel, pfd, 7%.	New York	118	117	117	Je.1, Jl.1 Q	1.75
Cleveland-Cliffs	Cleveland	230	199	206	Je. 6, Je. 15	5.00
Colo. Fuel & Iron	New York	61⅜	57	58		
Colo. F. & I., 1st pfd.	New York	...	...	78	My.10,My.25 Q	2.00
Great Northern Iron	New York	30½	26	28⅜	Dec.15, K	2.00
Inland Steel	New York	89	88⅜	89	My.15, Jn. 1, Q	0.87½
Republic I. & S.	New York	93	90	90	My. 11, Je. 1, Q	1.00
Republic I. & S., pfd.	New York	111¼	111	111	Je .12, Jl. 1, Q	1.75
Sloss-Sheffield S. & I.	New York	62	59½	59½	Mr. 11, Mr.20, Q	1.50
Sloss-Sheff. S. & I., pfd.	New York	....	....	106	Je.20, Jl.1, Q	1.75
U. S. Steel	New York	171⅛	165½	168		
U. S. Steel, new	New York	171	167½	170½		
U. S. Steel, pfd.	New York	141	140⅜	140½	My. 4,My 29, Q	1.75
Virginia I. C. & C.	New York	....	....	25½	Jan., 1924	1.50
Virginia I.C.& C., pfd.	New York	45	45	45	Jl.16, 1928 SA	2.50
MISCELLANEOUS						
Aluminum Co. of Am.	N. Y. Curb	287½	265	286		
Alum.Co.of Amer., pf.	N. Y. Curb	108½	107½	107½	Mr.15, Ap.1, Q	1.50
American Metal	New York	58½	55½	55½	My.9, Je. 1 Q	0.75
Amer. Metal, pfd., 6%	New York	116	115	116	My.21, Je.1, Q	1.50
Amer. Sm. & Ref.	New York	102	96	98½	Ap.12, My.14 Q	1.00
Amer. & Sm. Ref., pfd.	New York	133½	133	133	My. 3, Ju. 1 Q	1.75
Ang. Ch. Nitrate	N. Y. Curb	40⅜	38⅜	40⅜		
Asbestos Corp.	Montreal	11½	11	11	Jan. 1926	1.50
Asbestos Corp., pfd.	Montreal	39	35	35	De. 31, Ja. 15 Q	1.75
Consol. M. & S.	Montreal	385	380	382	De.31,Ja.15,SA	6.25
De Beers Consol.	New York	23	23	23	Ja. 19, Ja.26,	0.48
Federated Metals	N. Y. Curb	29	27	27½	Mr.27, Ap.5 Q	0.75
Freeport Texas	New York	47⅜	38½	46	Ap. 5, My. 1 Q	1.00
Int. Nickel Can.	New York	49⅜	45½	47⅜	Je.1, Je.29 Q	0.20
Int. Nickel, pfd.	New York	....	....	121	Ap.2,My.1	No.1Q1.75
Newmont	N. Y. Curb	203⅜	197	197⅜	Mr.30, Ap.15 Q	1.00
Patiño M. & E.	New York	38⅜	34⅜	36⅛	My. 31, Jn. 28	4s
So. America G. & P.	N. Y. Curb	2⅜	2⅜	2⅜		
Texas Gulf Sulphur	New York	74⅜	71½	72½	Je.1, Je.15 Q	1.00
U. S. Sm. R. & M.	New York	56½	52⅜	53	Ap. 4, Ap. 15 Q	0.87½
U. S. Sm. R. & M., pfd.	New York	53⅜	52½	52½	Ap. 4, Ap. 15 Q	0.87½
Vanadium Corp.	New York	79½	71⅜	76⅜	Fe.1, Fe. 15 Q	0.75

Toronto Standard Stock Exchange, Toronto, courtesy Arthur E. Moysey & Co.; Salt Lake Stock Exchange, courtesy J. A. Hogle & Co. and Logan & Bryan, New York; Standard Stock Exchange, Spokane, courtesy Pohlman Investment Company.

*Cents per share. †Bid or asked. Q, Quarterly. A. Annually. SA, Semi-annually. M, Monthly. BM, Bimonthly. FW, Four weeks. K, Irregular. I, Initial. R, Resumption. X, Extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

LONDON QUOTATIONS—WEEK ENDED MAY 28, 1929

	High	Low	Last	Date	Amount
Alaska Mexican ($5)	20/—	20/—	20/—		
Alaska Treadwell (25)	67/6	66/10½	67/3	Nov., 1926	4 p.c.(d)
Aramayo Mines (25 frs.)	61/10½	58/9	60/—	May 1929	5 p.c.(†)
Burma Corp (10 rupees)	18/—	17/6	17/7½	Feb., 1929	7 annas*
Bwana M'Kubwa (5s)	19/9	17/3	19/1½		
Camp Bird (2s)	2/4½	2/—	2/—	April, 1928	16⅛ p.c.
El Oro (£1)	5/3	4/10½	5/—	Nov., 1924	2½ p.c.*
Frontino & Bolivia (£)	8/9	8/9	8/9	Jan., 1929	3½ p.c.
International Nickel of Canada (Quoted in dollars with a fixed rate of $5 to the £1) (no par value)	$51⅛	$45⅛	$47⅛	Mar., 1929	20(c)
Mexican Corpn. (£1)	14/—	13/6	13/9		
Mexican Mines of El Oro (£1)	5/3	4/—	4/4½	Dec., 1926	3½ p.c.*
Mount Isa (£)	46/6	45/—	45/—		
N'Changa Copper Mining. (£1)	79/4½	70/—	75/—		
Oroville Dredging (4s)	1/9	1/7½	1/9	Nov., 1928	31½ p.c.
Rhodesian Congo Border (£1)	181/3	127/6	177/6		
St. John del Rey (£1)	17/9	16/10½	17/9	Apr., 1929	7½ p.c.
San Francisco Mines (10s)	36/9	35/3	36/9	Jan., 1929	25 p.c.
Santa Gertrudis (£1)	11/—	10/3	10/6	Jan, 1929	7½ p.c.
Selukwe (2s. 6d.)	6/4½	5/1½	6/3	April, 1917	6⅔ p.c.
S. Amer. Copper (2s.)	2/6	2/1½	2/4½	Nov. 1917	75 p.c.
Tanganyika (£1)	61/6	56/10½	57/6	July, 1928	5 p.c.
Union Miniere de Haut-Katanga (Brussels)	11,890	11,500	11,500	April, 1929	300.00 fr.

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian francs and free of taxation. (d) U. S. Dollars.